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ABSTRACT

A literature search conducted during the Project, Teaching Basic Skills Through Vocational Education, focused on three main topics: instructional program data, basic skills, and instructional materials. High enrollment areas and high employment areas were first identified using such instructional program data as enrollment patterns and projected job openings for program completers of vocational education. Location and analysis of developments in job-related basic skills was the second major task undertaken. The seven major studies identified provided a broad perspective for the project, served as guides in developing instructional materials, provided examples of the occupational application of concepts, generated instructional materials, and provided field tested instructional guides. The final task of the literature search was to identify instructional materials--texts that are significant and/or dominate the vocational commercial scene and vocationally relevant basic skills materials. (Appendixes, amounting to over one-half of the report, include a complete list of enrollment of vocational education programs and projected annual average openings, list of mathematics and communication skills and concepts, Basic Skills Distribution Chart for selected occupations, and three lists of instructional materials--significant and/or dominant commercially available vocational instructional materials, ERIC and CRIS searches, and vocational-related basic skills materials.) (YLB)

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TEACHING BASIC SKILLS THROUGH VOCATIONAL EDUCATION

TECHNICAL REPORT

Literature Search

U.S. DEPARTMENT OF EDUCATION
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April 1980

TEACHING BASIC SKILLS THROUGH VOCATIONAL EDUCATION

LITERATURE SEARCH

Cheng C. Liu

Cornell Institute for Occupational Education
Ithaca, New York

April 1980

CIOE

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PREFACE

The review of relevant literature is a critical part of any research and development effort. Its purpose is to determine the state of the art in these areas germaine to the research at hand so as to build on previously discovered information rather than having to rediscover it. An important intersection of two areas of the educational literature is evident from the title of this project, Basic Skill Development Through Vocational Education. Therefore, it was these two areas, basic skills and vocational education, which were the focus of the literature search (Task E) reported here.

The literature search had four focal points within the two broad areas just mentioned. Each focal point represents a key topic in the literature which is directly related to the Basic Skills project. These topics were incorporated into the subtasks specified in the project's technical proposal.

The technical proposal lists two major sub-tasks of the literature search. The first is to specify the basic skills required for entry-level jobs. Inherent in this task are two key topics. The first is the definition of basic skills and the second is an explanation of their relationship to vocational education areas. The next literature search task embodies a key topic: to identify assessment and instructional material options which may be recommended to secondary-level vocational teachers to assist them in providing basic skill instruction to their students. The major materials to be used to make recommendations to teachers are the project's Resource and Teacher Guides.

There was a fourth focal point and, therefore, another task which was deemed essential for the efficient implementation of the two major sub-tasks of the literature search. This supporting task was to determine those secondary-level vocational programs with the highest enrollment and,

where possible, those with the greatest potential for employment. In implementing this task, the foundation was laid for the efficient specification of basic skills, since only those jobs related to important programs would need to be analyzed. In addition, this task directed attention toward those assessment and instructional materials which would be interesting to large numbers of teachers. In so doing it set the stage for the organization of the Resource and Teacher Guides.

Consistent with the tasks associated with the literature search, this report contains three chapters. The first chapter describes the search for those programs of greatest enrollment and employment potential. The second chapter describes the research on basic skills associated with vocational education programs. The third chapter of this report describes instructional material options to be used in the Resource and Teacher Guides. The assessment options are discussed in detail in a separate deliverable on Standardized Test Selection (Task D) and Assessment Instruments for Measuring Occupational Competencies (Task F) by Walker.

There are four appendices at the end of this report. Each appendix contains specific information referred to in the body of the report. In the first appendix is the complete list of enrollment of vocational education programs and projected annual average openings. The other three appendices contain lists of instructional materials.

Thanks go to C. Liu for his thorough review of the literature as presented in this report and especially for his painstaking work on the Basic Skills Distribution Charts which appear in Appendix C. In this regard, thanks also go to L. Snyder for her expert typing of the charts, to P. Yeh for her assistance in compiling the information for them, and to L. Bentley for her competent typing of the final draft.

James A. Dunn
Principal Investigator and
Director, Cornell Institute for
Occupational Education

CHAPTER ONE
INSTRUCTIONAL PROGRAM DATA

Instructional program data were identified and analyzed in order to provide direction to the project. Several objectives were related to this supporting task as follows:

1. To understand current vocational education enrollment patterns at the national level.
2. To identify projected annual average openings for vocational education program completers at the national level.
3. To provide guidelines for the development of project materials.
4. To provide a rationale for selecting potential instructional programs for field testing of project materials.

The basic underlying assumption for the task was that in order to maximize the impact of the materials developed by the project, high enrollment and high employment demand areas should be identified and used to guide the development of the materials for field testing.

By assembling the most recent United States Office of Education (U.S.O.E.) vocational education program enrollment data (1978 program year) and employment and average annual projected openings data (1979-90) from the U. S. Bureau of Labor Statistics, guidelines were developed to accomplish project objectives. Appendix A provides a summary of secondary level vocational education program enrollment by U.S.O.E. vocational education program codes. Total enrollment and annual completions of all types of programs (i.e., secondary, post-secondary, adult, and cooperative education) are also included. Certain cells of the projected annual average openings of the Bureau of Labor Statistics publications are empty due to the complexity of deciding the source of entering workers' education and training backgrounds.

To enhance the utility of the compiled data for selecting vocational instructional programs, and to guide the literature search of assessment and instructional materials, the following procedures were implemented.

Procedures

A list of potential instructional programs for field testing was developed by applying the following criteria:

a. strong secondary enrollment, as compared to total enrollment (a high Secondary Enrollment Domination Index value),
b. high growth opportunities, as defined by an estimated average annual openings in excess of annual completions, and
c. occupationally directed programs (these excluded industrial arts, consumer education, and vocational guidance programs).

A Secondary Enrollment Domination Index (SEDI) was calculated for each program. This index is the ratio of secondary vocational program enrollment to total vocational program enrollment:

$$\text{SEDI} = \frac{\text{Secondary Vocational Enrollment}}{\text{Total Vocational Enrollment}} .$$

Inasmuch as this project is concerned with only secondary level basic skills development, it is reasonable to select those programs with high values of SEDI.

A Growth Index was also calculated. Here the index is the ratio of projected average annual openings in the labor market to total annual completions of vocational education programs:

$$GI = \frac{\text{projected average annual openings}}{\text{total annual completions}}$$

GI >1 indicates growth

GI $= 1$ indicates no growth

GI <1 indicates saturation

Results

Table 1 shows the secondary vocational programs selected for their high secondary enrollment and high employment demand. The predominant criterion used in the selection was the Secondary Enrollment Domination Index value since not all programs had GI information. The SEDI represents the percentage of enrollment that is at the secondary level. For example, in the distributive education occupational area, 63% of the enrollees of program 04.0800, General Merchandising, are in secondary level vocational programs compared to only 37% in post-secondary, adult and cooperative education programs. High Growth Index values are reported whenever available. All the selected vocational programs are occupationally directed programs.

As shown in Table 1 a minimum of three U.S.O.E. instructional programs were selected from six vocational service areas: Agriculture, Distributive Education, Health, Occupational Home Economics, Office Occupations, and Trades and Industry. Only one vocational program was selected from Technical Education, since this area has a relatively small number of secondary students. Due to the diversity of instructional programs and significant enrollments within the trade and industrial educational area, eleven programs were selected here. Examples of courses and curricula from selected vocational instructional programs are illustrated in Table 2. Those courses and curricula with an asterisk before them are the ones for which we found information about relevant basic skills.

Implications

There are two major implications of the data presented in Tables 1 and 2. The first concerns their utility for guiding the efficient organization of other parts of the research associated with the Basic Skills Project. For example, many different studies of basic skills related to vocational education are presented in the next chapter of this report. However, only the data on programs with high SEDIs and, when possible, GIs will be subjected to further analysis in preparation for their use in developing sets of generic basic skills for the Resource and Teacher Guides.

A second implication of the results of the first literature search is the identification of programs on which it would be appropriate to focus. It would be impossible to include in the project's Resource and Teacher Guides examples from all vocational education programs. But, by determining those programs with the highest SEDIs and, when possible, with the highest GIs, the guides can be written to appeal to the greatest numbers of potential users. Both of these implications will enhance the guides' usability, effectiveness, and generalizability: the three evaluation criteria by which the guides will be judged.

Table 1

MAJOR SECONDARY SCHOOL VOCATIONAL PROGRAMS
FOR FIELD TEST CONSIDERATION

OCC. ED. AREA	U.S.O.E. CODE	PROGRAM TITLE	SFDI	GI
Ag. Ed.	01.0100	Ag. Production	0.65	--
	01.0300	Ag. Mechanics	0.81	--
	01.0500	Ag. Ornamental Horticulture	0.64	--
Dist. Ed.	04.0200	Apparel and Accessories	0.66	--
	04.0700	Food Services	0.60	--
	04.0800	General Merchandising	0.63	4.33
Health Ed.	07.0101	Dental Assisting	0.37	1.37
	07.0303	Nursing Assisting	0.30	2.22
	07.0904	Medical Assisting	0.37	--
Occ. H. E.	09.0201	Care & Guidance of Children	0.42	--
	09.0202	Clothing, Mgt., Prod. Services	0.68	--
	09.0203	Food Mgt., Prod., Service	0.70	--
Office Ed.	14.0100	Accounting & Computing	0.52	2.40
	14.0300	Filing, Office Machines	0.77	--
	14.0700	Steno., Secy., & Related	0.56	1.79
	14.0900	Typing & Related	0.72	0.41
Tech. Ed.	16.0108	Electronic Technology	0.10	0.31
T. & I.	17.0301	Automotive Body & Fender	0.53	0.33
	17.0302	Automotive Mechanics	0.62	0.37
	17.1001	Carpentry	0.60	1.30
	17.1300	Drafting Occupations	0.64	0.33
	17.1500	Electronics Occupations	0.49	--
	17.1900	Graphic Arts Occupations	0.49	--
	17.2302	Machine Shop	0.48	1.35
	17.2306	Welding and Cutting	0.28	0.68
	17.2602	Cosmetology	0.66	1.05
	17.2900	Quantity Food Occupation	0.54	13.57
	17.3600	Woodworking Occupations	0.66	--

Table 2

SELECTED VOCATIONAL PROGRAMS AND EXAMPLES OF COURSES AND CURRICULA

USOE Code	Program Title	Examples of Courses and Curricula
01.0100	Agriculture Production	*Farm Management
		Crop Production
		Soil Use and Management
		Agronomy
		Animal Science
		Animal Husbandry
		Laboratory Animal Caretaker
		Poultry Science
01.0300	Agriculture Mechanics	Agriculture Mechanization
		Farm Mechanics
		*Agri-industrial Equipment Service
01.0500	Agricultural Ornamental Horticulture	*Wholesale Florist
		*Horticulture Equipment & Service
		*Retail Florist
		*Landscape Service Person
		*Garden Center Employee
		Ornamental Horticulture
		Horticulture
		Floriculture
		Floral Design & Arrangement
		Floriculture Merchandising & Production
		Greenhouse Occupations
		Landscaping and Design
		Turf Management
04.0200	Apparel and Accessories	Fashion Merchandising
04.0700	Food Services	(sales and sales supporting)
04.0800	General Merchandising	Distribution
		Introduction to Marketing
		Marketing/Business
		*General Sales
		Direct Selling
		Merchandising & Sales Supporting
		Retail Business Management
		Retailing
		Wholesaling
		Foreign Trade
		*Small Business Manager
07.0101	Dental Assisting	*Dental Assistant
07.0303	Nursing Assisting	Nurse's Aide Services
		Nursery Assistant
07.0904	Medical Assisting	*Medical Assistant (assisting in physician's office)
09.0201	Care and Guidance of Children	Child Care Services
		Nursery Education
		*Nursery Teacher's Aide
09.0202	Clothing Management, Production and Services	Clothing Services
		Dry Cleaning/Laundering
09.0203	Food Management, Production and Services	*Food Services - Front of House
		Waiter/Waitress
		*Catering
14.0100	Accounting and Computing (Bookkeeping)	Accounting
		*Machine Bookkeeping
		*Bank Teller
		Recordkeeping
		Income Tax Preparation
		*Data Accountant
		*Bookkeeper

USOE Code	Program Title	Examples of Courses and Curricula
14.0300	Filing, Office Machines	Clerical Practice Office Practice Office Machine Operations Filing Office Reproduction Equipment Operation Machine Transcription *Information Receptionist *Clerical Aide *Terminal Clerk *Word Processor
14.0700	Stenographic, Secretarial and Related Occupations	Manual Shorthand Manual Shorthand Transcription Accelerated Shorthand Machine Shorthand Secretarial Practice *Secretary--Medical, Legal, Executive, etc.
14.0900	Typing & Related	Typist
16.0108	Electronic Technology	Electronics (Technical) Industrial Electronics Technology Computer Circuitry *Telecommunications
17.0301	Automotive Body and Fender	*Auto Body Mechanic
17.0302	Automotive Mechanics	*Auto Mechanics *Automotive Service Specialist
17.1001	Carpentry	*Carpenter
17.1300	Drafting Occupations	Mechanical Drafting Industrial Drafting Architectural Drafting Electrical/Electronics Drafting Drafting Technology Bluespring Reading *Draftsman
17.1500	Electronics Occupations	Industrial Electronics *Radio & TV Repair *Telecommunications Electronic Technician
17.1900	Graphic Arts Occupations	General Printing Offset Lithography *Offset Press Operator *Lithocameraman *Offset Plate Maker *Bindery *Offset Stripper *Layout & Design Compositor
17.2302	Machine Shop	Machinist & Machine Operator *Machine Tradesman Tool and Die Maker Pattern and Model Maker
17.2306	Welding and Cutting	*Welders and Flame Cutters Solderers
17.2602	Cosmetology	*Cosmetology/Beauty Culture
17.2900	Quantity Food Occupations	Commercial Foods *Baker *Cook/Chef *Salad Maker *Fast Food Counter Person *Fast Food Manager Food Processing Meatcutting/Packaging Hostess Training Domestic Food Trades
17.3600	Woodworking Occupations	Cabinet Making Furniture and Wood Finishers *Millwright

* Basic Skills Distribution Chart available.

CHAPTER TWO

BASIC SKILLS

The next major task undertaken in the literature search was to locate and analyze developments in job-related basic skills. As a result of our search, seven major studies were identified which contained information relavant to our project. In this chapter each of these studies is described and the implications for the project are stated.

Generic Skills - A Canadian Approach

Generic Skills is a project of the Advanced Development Division of the Occupational and Career Analysis and Development Branch, Canada Employment and Immigration Commission. The senior consultant, Arthur Smith (1978) stated that generic skills are those job behaviors which one actively used in work performance, which are transferable from one job or occupation to another and which are needed for promotion to higher level positions. By this definition most communications, arithmetic and reasoning skills are highly generic, but advanced algebra and science skills are not.

The generic approach is an attempt to examine the commonality of skills among occupations/jobs rather than their uniqueness. Examples of generic skills are listed below (Smith, 1978).

1. Academic skills - multiplying whole numbers and reading to determine job requirements.
2. Manipulative skills - hand/eye coordination and using proper body posture for lifting.
3. Science skills - using the scientific method to solve job related problems.
4. Reasoning skills - scheduling work and diagnosing work problems.
5. Interpersonal skills - giving and receiving rewards and discipline.

The major objective of the Canadian approach is to formulate generic skills to identify their uses for certain occupational groups, and to prepare specifications for instructional modules in an attempt to provide greater flexibility in training. Another objective of the study is to determine skill transferability between jobs/occupations. Workers have been surveyed in 49 occupations and "supervisors as workers" have been surveyed in 28 occupations. The agreement on the skills requirements between workers and the workers' immediate supervisors has been extremely high.

Figure 1, Generic Communication Skills, summarizes the communication requirements for 10 occupational families and for 28 foreman/supervisory occupations. The shade (color in original) code indicates the ratio of occupations in which the skill is used by the workers.

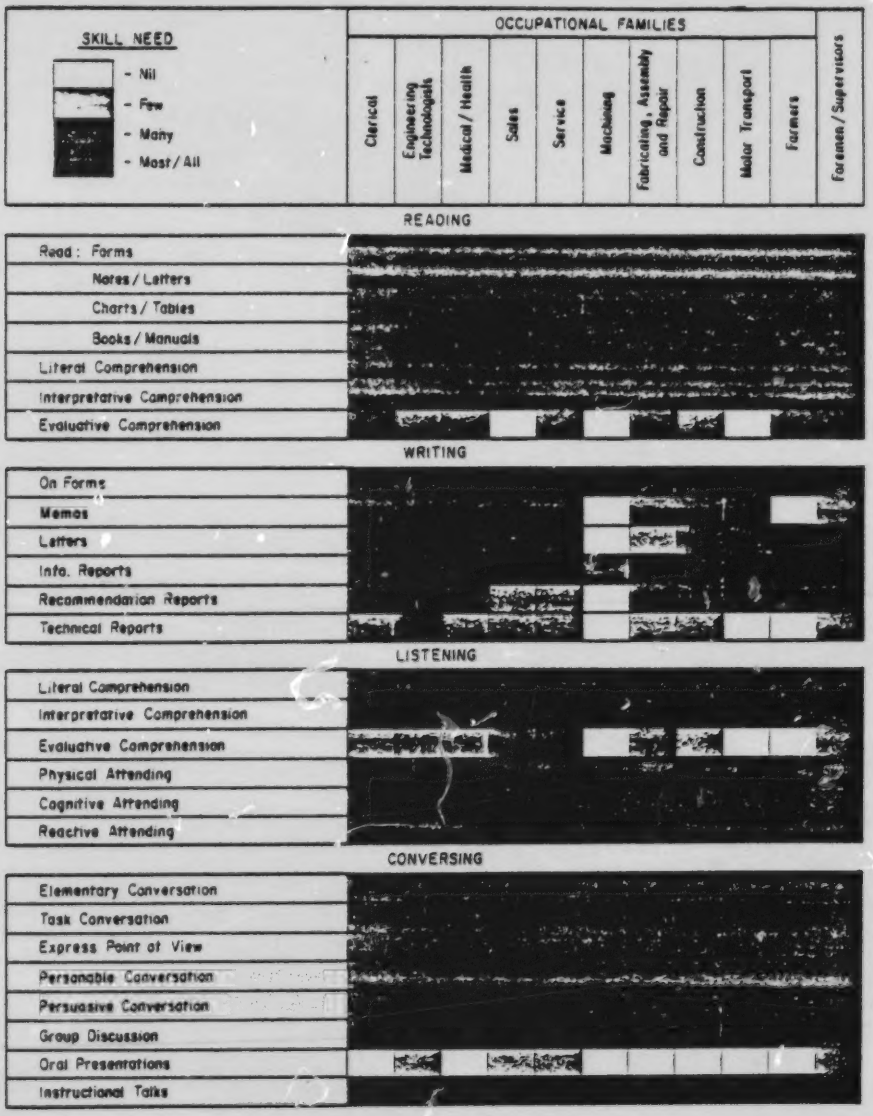
Figure 2, Generic Mathematics Skills, summarize the mathematics requirements for 10 occupational families and for 28 foreman/supervisory occupations. The shade (color in original) code indicates the ratio of occupations in which the skill is used by the workers.

Implication for Basic Skills Project

Despite differences between the objectives of the Generic Skills project and our Basic Skills project, the skills categories of the Generic Skills project (i.e., generic communication skills, generic mathematics skills) are remarkably useful. Data contained in Figure 1 and Figure 2 can be used as a general guide to basic skills which should be included in instructional materials. However, one major weakness concerning the usefulness of the generic skills data is that both the skills and occupational families dimensions are too general to indicate precisely those skills and jobs which are related.

Figure 1

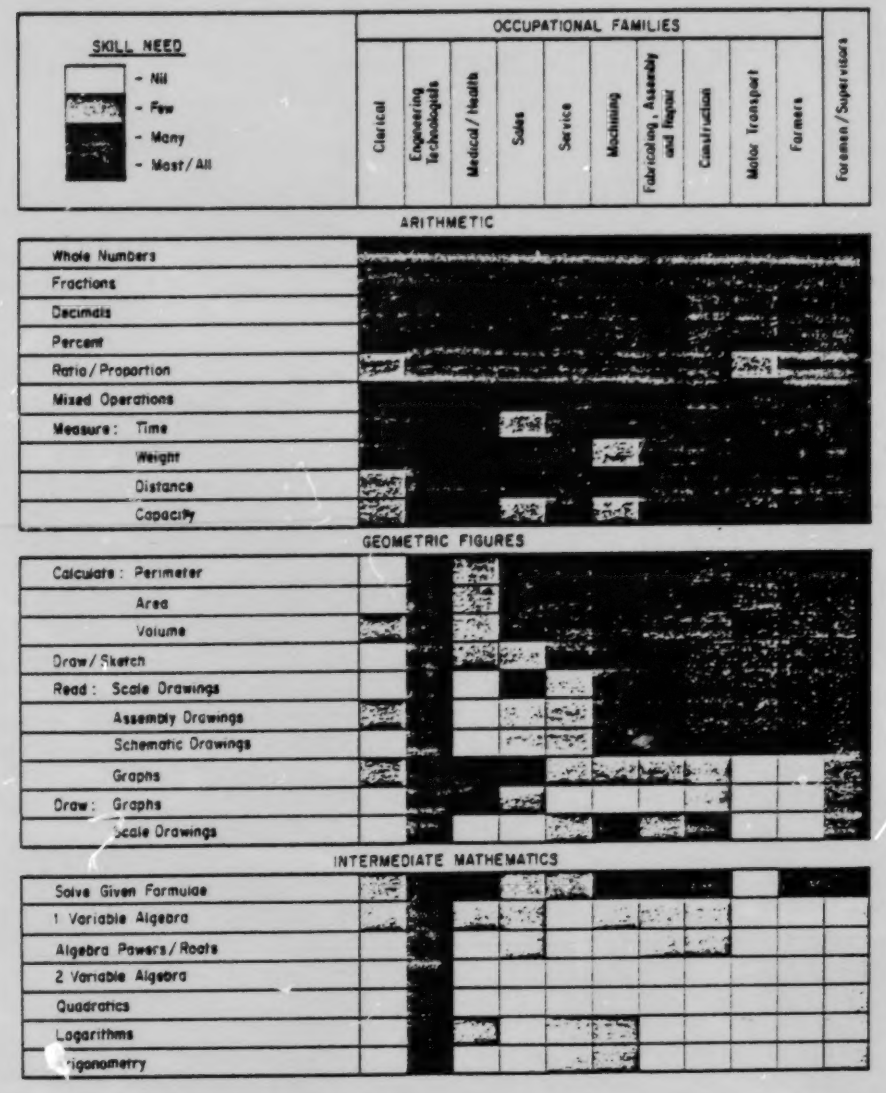
CANADIAN APPROACH'S GENERIC COMMUNICATION SKILLS*



* Smith (1978)

Figure 2

CANADIAN APPROACH'S GENERIC MATHEMATICS SKILLS*



* Smith (1978)

The Occupational Analysis Approach

The Occupational Analysis project was conducted by the Instructional Materials Laboratory, Trade and Industrial Education, the Ohio State University in conjunction with the Ohio State Department of Education, Division of Vocational Education pursuant to a grant from the U.S. Office of Education.

The occupational analysis approach was used to train vocational educators in making a comprehensive occupational analysis including not only job tasks but also basic skills in communications and math. Instructors were selected from agriculture, business, distributive, home economics, and trade and industrial education. Representatives from business, industry, and education were involved with the vocational instructors in conducting the analysis.

The analysis process was thorough in scope and execution. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists in math and communications.

Occupational analysis data were generated for 98 occupations/jobs. The analysis included a statement of the various tasks performed in each occupation/job. For each task the following items were identified:

tools and equipment
procedural knowledge
safety knowledge
concepts and skills of mathematics
concepts and skills of science
concepts and skills of communications.

The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures, as well as identifying specific supporting skills and knowledge

in the academic subject areas. Figure 3 shows a sample task statement of the occupational analysis of the Auto Body Mechanic occupation (Strank and Speck, 1974).

Implications for Basic Skills Project

The uniqueness of the Occupational Analysis Approach is that detailed basic skills requirements for successful performance of a specific task are analyzed. In order to simplify the information presented in the task analyses C. Liu has developed a Basic Skills Distribution Chart for each occupation. The basic skills listed in the sample chart (Figure 4) were generated by analyzing the mathematics and communication cells of the task analyses illustrated in Figure 3. In Appendix B are listed those mathematics and communication skills and concepts which were used in the original occupational analyses resulting in the task analyses illustrated by Figure 3. Together the basic skills distribution charts in Appendix C and the list of skills and concepts in Appendix B will be invaluable in the generation of generic skills. They will be combined with the results of analyzing tests of basic skills (reported by Walker) and used to give vocational educators a tool to construct locally relevant definitions of basic skills.

Figure 3

SAMPLE TASK ANALYSIS FOR AUTO BODY MECHANICS *

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Standard tool kit Body and frame manuals Safety stands Front suspension tools Engine hoist and chair fall Air wrench Alignment rack Frame	Remove bumpers, front sheet metal and cooling system Remove body Remove engine and drive train Remove exhaust system and gas tank Remove wiring and brake lines Remove front suspension and steering parts Reinstall all parts in the reverse a order of removal Inspect electrical system Inspect cooling system Align front suspension Road test	Eye protection - eye injury Safety stand placement - auto falling Engine hoist and chain fall operated with care - personal injury Safety rules on compressed air for air wrench Gasoline inflammable - care taken in removal and storage of gas tank - fire

DECISIONS	CUES	ERRORS
Whether to repair or replace	Total cost	High cost

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [standard tool kit and engine hoist and chain fall] Centrifugal forces developed by bodies in rotation [air wrench in rotation] Fluids under pressure [compressed air] Effects of friction on work processes and product quality [removal of bolt on parts] Behavioral Science (see index)	Linear measurement - tape measure Fractions Use of numbers (without calculations) Recording Coding [wrenches] Measurement: geometric [alignment gauges] Angle Read and interpret graphs, charts, and tables [alignment charts]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Frame and body manuals	Comprehension, detail/inference, speed/rate, informational record, recommendation record, description of mechanism, definition, terminology
Seeing	Removal, replacement, and alignment of parts	Visual analysis, memory, describing, logic, detail/inference, recognition of symbols, codes, emblems
Speaking	Questioning shop foreman	Terminology/general vocabulary, clarity of expression, logic

*Strank and Speck (1.77)

Figure 4

SAMPLE BASIC SKILLS DISTRIBUTION CHART*

BASIC SKILLS PROJECT

Automotive Body Mechanic
Program - 17.0301

BASIC SKILLS DISTRIBUTION CHART

TASK STATEMENTS	MATH: Deduction	MATH: Fundamental Operations +,-,x,÷	MATH: Use of numbers (without calculations) coding	MATH: Use of numbers recording	MATH: Rationals	MATH: Order of operations	MATH: Whole numbers-decimals	MATH: Measurement	MATH: Ratio and Proportion	MATH: Fractions	MATH: Read and interpret tables	MATH: Use of numbers	MATH: Analyze	COMMUNICATION: SPEAKING: Terminology/general vocabulary	SPEAKING: Clarity of expression	SPEAKING: Logic	SPEAKING: Appropriate diction	SPEAKING: Implying enunciation	COMMUNICATION: WRITING: Penmanship	WRITING: Classification	WRITING: Description	WRITING: Terminology	WRITING: Usage	COMMUNICATION: LISTENING: Auditory discrimination	LISTENING: Discriminate facts from nonfacts	LISTENING: Recognize opinions	LISTENING: Logic	COMMUNICATION: READING: Comprehension	READING: Recommendation reports	READING: Detail/inferences	READING: Information report	READING: Description of mechanisms	READING: Definition	READING: Speed/rate	READING: Terminology	READING: Instructions
A-1 Write estimates	✓	✓				✓								✓	✓		✓	✓	✓	✓	✓	✓	✓												
A-2 File estimates alphabetically			✓																															
A-3 Verify insurance coverage				✓										✓	✓				✓	✓	✓	✓	✓							✓				✓	
A-4 Order parts and materials	✓		✓											✓	✓		✓	✓	✓	✓	✓	✓	✓						✓		✓			
A-5 Schedule work				✓										✓	✓				✓		✓	✓												
A-6 Write repair orders and record parts and materials		✓	✓	✓															✓	✓	✓	✓	✓								✓			
A-7 Record costs, payments, deposits		✓	✓		✓	✓								✓					✓	✓										✓				
A-8 Keep payroll records		✓			✓	✓													✓	✓														
A-9 Order and maintain tools and equipment			✓																✓	✓	✓													
A-10 Establish safety regulations														✓	✓		✓	✓																
A-11 Handle customer complaints														✓	✓		✓	✓																
B-1 Wash and dewax vehicle			✓											✓	✓	✓													✓		✓			
B-2 Remove decorative features														✓	✓	✓																		
B-3 Ascertain type of original finish and type to be used	✓													✓		✓													✓	✓			✓	
B-4 Inspect old surface for defects																																		
B-5 Featheredge broken surfaces			✓											✓		✓													✓		✓			
B-6 Mix and reduce refinishing materials		✓						✓	✓					✓	✓	✓													✓	✓	✓			
B-7 Treat bare metal								✓	✓																									
B-8 Mask operations								✓																					✓	✓	✓			
B-9 Apply primer surfacer and glazing putty									✓					✓															✓	✓	✓			
B-10 Sand old finish, primer surfacer and glazing putty			✓					✓	✓					✓	✓	✓													✓	✓	✓			
B-11 Prepare for alkyd enamel refinishing								✓	✓					✓	✓	✓													✓	✓	✓			
B-12 Refinish with acrylic enamel				✓				✓	✓					✓	✓	✓													✓	✓	✓			
B-13 Prepare for polyurethane enamel refinishing			✓					✓	✓					✓	✓	✓													✓	✓	✓			
B-14 Prepare for acrylic lacquer refinishing			✓					✓	✓					✓	✓	✓													✓	✓	✓			
B-15 Spot refinishing and touch up			✓					✓	✓					✓	✓	✓													✓	✓	✓			
B-16 Polish lacquer finishes			✓											✓	✓	✓													✓	✓	✓			
B-17 Applying striping and decals			✓					✓						✓	✓	✓													✓	✓	✓			
B-18 Clean up and prepare for delivery									✓					✓	✓	✓								✓	✓	✓	✓							

*C. Liu based on data from
Strank and Speck (1974)

The Related Concepts Approach

The Minneapolis Public Schools, with support from the Minnesota Department of Education and the Minnesota Instructional Materials Center has developed two related concept guides on mathematics and English (Department of Vocational-Technical Education, 1978)
The purposes of the guides are to:

1. Assist students in making wise selections of math or English courses in pursuit of their vocational goals.
2. Assist teachers to become aware of the math/English concepts needed by students in their vocational areas.
3. Provide examples for math/English instructors to use in teaching these related concepts.
4. Help facilitate individual student learning.
5. Interrelate the disciplines of math/English and vocational education.

The guides are designed to enable teachers to provide greater opportunity for students to satisfy their particular needs within the framework of the existing math/English curricula.

The Minneapolis project is a practical approach to combining specific skills of two disciplines to form an interrelated curriculum using the "Related Concepts Guide." The strategy provides students with opportunities to effect transfer and to apply concepts/skills learned in one subject to another. At the same time they experience an accurate, relevant, realistic and comprehensive understanding of an occupation. Math/English instructors can use the guides as vehicles for exercising their responsibility to relate their subject matter to the world of work their students now face or will encounter after leaving school. Counselors can use the materials as tools to inform students of the related math/English skills needed to succeed in life as well as in particular occupations.

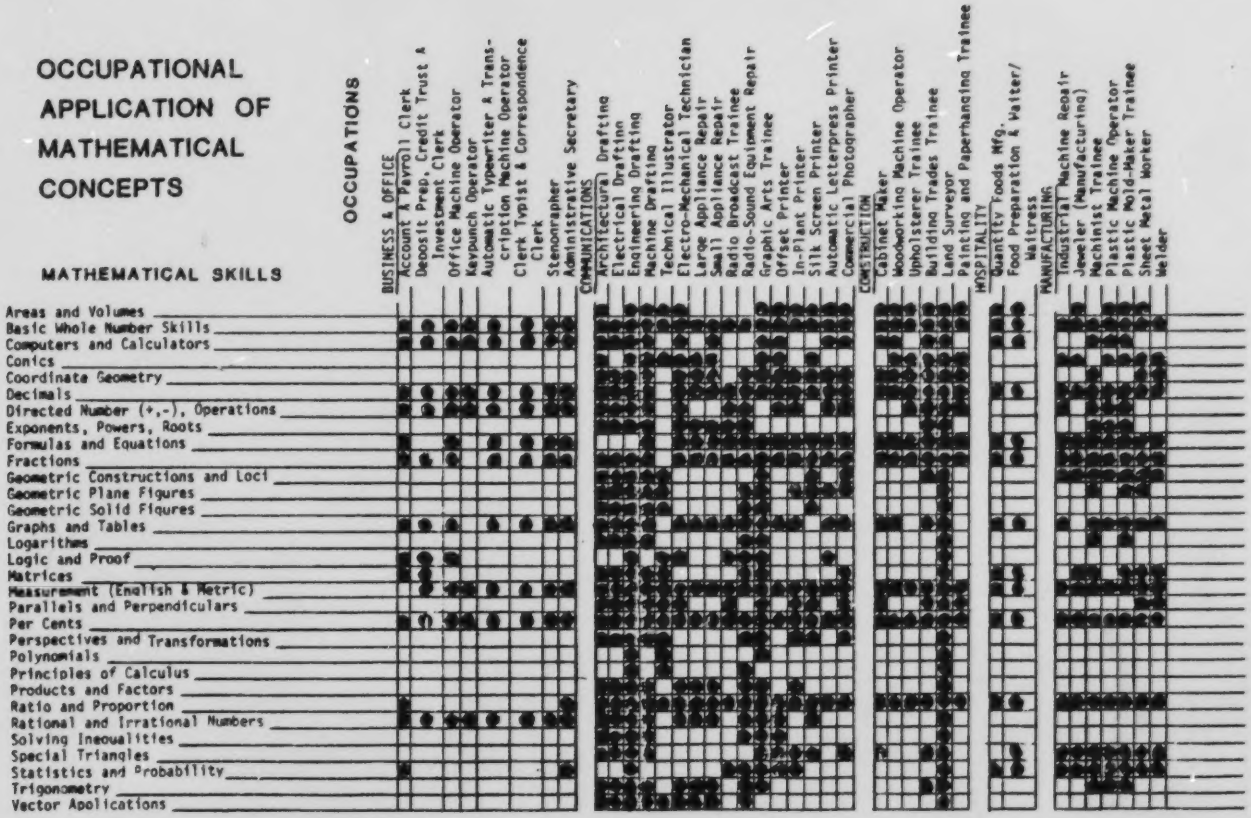
Implications for Basic Skills Project

The related concepts approach attempts to improve or reinforce the learning of basic skills in regular math/English courses while our Basic Skills project is developing Resource and Teacher Guides to assist vocational instructors to design instructional activities capable of meeting the basic academic skills needs of their students. Appropriate segments of the Related Concepts Guide will also be of use to the vocational teacher to facilitate closer working relationships with other faculty members. The two projects are different in focus.

The Minneapolis math/English skills vs. occupations charts demonstrate some degree of similarity with the Canadian generic skills' charts, except that the Minneapolis charts are somewhat more detailed on both dimensions. A sample chart is shown in Figure 5. In addition, the Minneapolis related Concepts Guides provide examples of occupational applications of concepts (Figure 6). As a whole they can provide valuable references in developing our Resource and Teacher Guides.

Figure 5

MATHEMATICS SKILLS VS. OCCUPATIONS*



*Department of Vocational-Technical Education (1978)

Figure 6

OCCUPATIONAL APPLICATIONS OF MATHEMATIC CONCEPTS*

Mathematics Supplemental Guide
For Related Concepts

Guide: Electricity I
#9614

Math Concept Taught	Math Course Taught In	Occupational Application of Concept	Other Area of Application
Read a scale	General Math	Read a VOM. See Appendix Problems 1,2	Science
Add, subtract, multiply, divide round whole numbers, fractions, decimals	General Math	Compute voltage on VOM scale, solving Ohm's Law, converting units. See Appendix Problems 2, 4, 7	Science
Understand metric prefixes, symbols, calculate in metric	General Math	Recognize units of power. Convert powers over. See Appendix Problems 3, 7, 10	Science (Physics)
Read a graph	General Math	Understand sine wave 4. Understand Alternators. See Appendix Problem 4.	Physics
Proportion	General Math Algebra Geometry	Magnetic attraction. See Appendix Problem 5.	Science
Use Percents	General Math	Calculate tolerance range of a system, understand output and efficiency. See Appendix Prob. 6.	Science, Soc. Studies, Economics
Use formulas by substituting values, solving formulas for other unknowns.	Algebra	Convert units, solve Ohm's Law problems involving amperes, volts, resistance and watts. See Appendix Problems 7, 8, 9, 10.	Science, Economics

*Department of Vocational-Technical Education (1978)

The Pennsylvania Survey

Long's Survey study (1973) determined which basic mathematics skills are necessary for success in various secondary vocational programs. It also determined which basic mathematics skills need most remedial attention by students entering secondary vocational programs.

Walker, of our project staff, identified important skills in mathematics through secondary analysis of the Pennsylvania Survey of vocational teachers (Long, 1973) and confirmed the skills' importance using a published analysis of the contents of tests (Hoepfner, 1978).

In the survey research, the respondents were 4300 vocational teachers at the secondary level in Pennsylvania, representing 60 programs within eight vocational areas. These teachers were given a listing of 66 basic skills in mathematics. They were instructed to check off the skills which are essential for their students' success in their vocational speciality.

In Walker's secondary analysis a skill was arbitrarily defined as <u>important</u> when $\geq$ 70% of the teachers in an area checked it as being essential. It was defined as generic for a <u>wide variety</u> of occupations when the $\geq$ 70% threshold was met in $\geq$ 4 of the 8 program areas. Using these arbitrary thresholds, this study found the set of 30 generic skills displayed in Figure 7. When the cutoff for numbers of program areas is lowered to three, the set increases by seven skills; when it is raised to five, it decreases by only three. These thresholds can be manipulated so that the set of skills is large enough to be useful to teachers and small enough to be manageable by project staff.

These results are confirmed by an analysis of the skills measured by standardized tests (Hoepfner, 1978). For this study the domain of mathematics was exhaustively divided into thirteen broad skill areas. Items on the seven most widely used tests of mathematics were reviewed and assigned to one of the thirteen areas. Data were reported in terms

of the proportion of items per test which measured each of the areas. The data for tests of grades four through eight were reviewed in the present search for generic skills.*

A skill area was defined as generally important when the median percentage of items per test measuring the skill was greater than 8%. This cutoff was a natural breaking point in the observed data. By that criterion, there were five general skills areas in mathematics. These five are marked with asterisks in the list of skill areas measured on four or more of the tests (See Figure 7). These results generally parallel and confirm those of the survey discussed earlier. Differences in the results of the two studies are due mostly to the fact that Long's survey aimed at a somewhat lower level of skills.

Implication for Basic Skills Project

By combining the Minneapolis Related Concepts charts, the Canadian Generic Skills charts, and Walker's analysis of Long's rank ordering of basic math skills tables we can derive a comprehensive occupationally related basic skills taxonomy. This taxonomy may suggest many basic skills instructional options.

*The seven tests used in Hoepfner's analysis were: The California Achievement Test, The Comprehensive Test of Basic Skills, The Cooperative Primary/STEP series, The Iowa Tests of Basic Skills, The Metropolitan Achievement Series, The SRA Achievement Series, and The Stanford Achievement Test.

Figure 7

GENERIC OCCUPATIONAL RELATED MATHEMATICS SKILLS

Name of Skills

Long (1973)	Hoepfner (1978)
The four basic operations of integers	Numbers and sets
The four basic operations with fractions	*Number systems and principles
Reducing fractions to the lowest terms	*Computation with whole numbers
The four basic operations with decimals	*Computation with fractions/ decimals/percents
Changing decimals to common fractions	*Word problems
Changing common fractions to decimals	*Measurement
Reading, writing, decimals	Tables/graphs/statistics
Rounding off decimals	Business/consumer/vocational mathematics
Multiplying and dividing integers and decimals by 10, 100...	Geometric objects and relations
Meaning of %	Plane and solid geometry
Finding % of a number	Algebra
Changing % to decimals	Advanced algebra
Changing decimals to %	
Addition, subtraction, multiplication with mixed numbers	
Rounding numbers	
Reading large numbers	
Averages	
Liquid measures	

Reading and Language Arts Analysis

In the domains of reading and writing, no source has been found that is comparable to the Pennsylvania Survey study. The closest counterpart, a survey of over 400 vocational teachers in Florida (Redmann, 1979), is a rating of the importance in vocational education of 58 skills in teaching reading. However, the analysis of tests cited above (Hoepfner, 1978) also covered tests of reading.* This analysis resulted in categories which are so broad and so few in number that it was decided that a more revealing analysis was needed. Appropriate levels of the following five test batteries were used by Walker in this analysis:

- Analysis of Skills (Reading and Language Arts) by Scholastic Testing Service;
- Metropolitan Achievement Test (Reading and Language Instructional Tests) by Psychological Corporation;
- National Assessment of Educational Progress by Educational Commission of the States;
- Prescriptive Readings Inventory by CTB McGraw-Hill;
- SCORE Criterion-Referenced Testing Services by Houghton-Mifflin.

These batteries were chosen to sample the major test publishers (Psychological Corporation, CTB McGraw-Hill, and Houghton-Mifflin), a smaller publisher of a comprehensive battery (Scholastic Testing Service), and a respected test developer which has no commercial biases (Education Commission of the States). The tests used were criterion-referenced, currently on the market, and designed for testing in the fourth to eighth grade range. Criterion-referenced tests were used because they identify the tested skills relatively clearly and because they reflect curriculum relatively well. In comparison, norm-referenced tests usually do not describe the tested skills in any detail, and they are designed to exclude skills that are "easy" (i.e., widely taught and learned).

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* These skill areas were measured on four or more of the tests analyzed by Hoepfner.

To start the analysis of test materials, objectives for all of the tests were grouped under general headings such as punctuation, syntax, usage, literal comprehension, and the like. Then objectives were grouped into progressively more specific categories. Wherever objectives were cryptic, items for the tests were studied to determine actual skills measured. This step was necessary for 120 items of the Metropolitan on reading comprehension, and a large number of items on punctuation, capitalization, and usage on the Analysis of Skills.

Skills were identified as generic when at least three of the five test batteries covered them. The skills in Figure 8 represent the category headings for objectives covered in three to five test batteries.

Implications for the Basic Skills Project

One issue that needs to be dealt with in the project's Guides is how to address audiences whose basic skills needs differ markedly from generic skills. This issue is raised by the program level data in the Pennsylvania Study (Long, 1973), where several specific programs exhibit unusual patterns of essential basic skills. For example, the five most important mathematical skills for mill and cabinet making and for sheet metal work are not among the generic skills identified. Similarly, twelve of the 17 most essential skills for plumbing are not identified as generic. Although these exceptions are rare, they need to be recognized in the project's Guides. There may be similar instances in regard to reading. By cross-validating basic skills in relation to particular vocational areas it will eventually be possible to establish a list of generic skills and those skills associated only with particular programs.

Figure 8

GENERIC SKILLS IN READING AND LANGUAGE ARTS*

Reading

Phonic Analysis
Structural Analysis
Parts of Speech
Syntax
Literal Meaning of Words or Phrases
Literal Comprehension
Inferential Comprehension
Interpretive or Critical Comprehension
Reference Skills
    Using a dictionary
    Parts of a book
    Other sources

Writing

Spelling
Punctuation
Capitalization
Usage

*Based on Walker's analysis

The Human Resources Research Organization (HumRRO) Effort

HumRRO work in functional literacy has been sponsored primarily by funding from the Army, the Department of Defense, and the Air Force. Some work has been funded by the National Institute of Education. Dr. Thomas G. Sticht has been the leader of this research program since its inception at HumRRO's Western Division. Sticht (1975) reported that HumRRO's Initial Work Unit REALISTIC was followed by Work Units READNEED, LISTEN, and FLIT. The research activities expanded to encompass the study not only of the literacy demands of Army jobs, but also of methods for reducing these demands and for improving the reading skills of personnel through literacy training. All of HumRRO's research and development has focused on the study of literacy in relation to work.

According to Sticht (1975), two major factors have stimulated work on job-related literacy: (a) people want job-relevant skills; and (b) literacy skills are the most salient of the formally acquired skills demanded by various occupations.

Implications for Basic Skills Project

The FORCAST readability index for technical reading materials appears to be one of the formulas with the potential for use by vocational educators in assessing readability of technical publications and products brochures that are commonly used in vocational schools. Information about the correlations among the Flesch, Dale-Chall, and FORCAST formulas indicated that the simplified FORCAST formula produced a more accurate estimate of the reading difficulty of Army job reading materials.

Among other conclusions from years of work on functional literacy, Sticht (1975) stated (a) there appears to be little information regarding the demands for literacy skills in various occupational programs; and (b) reading skills for learning a job, as in vocational education courses, may differ from the skills needed to do a job. Considerations should be given to these factors in identifying instructional materials and developing our basic skill taxonomy.

Reading Power in the Content Areas (VRP)

Vocational Reading Power (VRP) is a staff development project designed to make content area teachers aware of the discrepancy between student reading abilities and the reading requirements of printed instructional materials (Butz and Gundabalan, 1978). The objectives of the VRP are:

1. To narrow the gap between student reading ability and the skill level required to read printed instructional materials.
2. To enrich the knowledge, attitudes, and skills of content area teachers.
3. To increase student learning of content areas.

VRP (Vocational Reading Power) development began in the Oakland Schools, Pontiac, Michigan in 1967. In 1974 the Joint Dissemination Review Panel in HEW approved it for replication by schools throughout the country. The project was originally validated for grades 11-12 vocational students from a broad range of ethnic and socio-economic backgrounds. Since that time, VRP has been successfully implemented in both vocational and non-vocational classes in grades 7 through post-secondary. The components of VRP are as follows:

1. Readability analysis of printed instructional materials.
2. The test component presents information on reading tests ranging from standardized, commercially developed and marketed tests to informal teacher developed tests.
3. Vocabulary development - the key element of the VRP program. The VRP materials provide many ideas on how instructors can formally teach the language specific to their course content area, as well as how to develop lists of "need-to-know" glossaries for other courses. VRP compiled thirty-two vocational-technical occupation/job glossaries.
4. Reading in the Content Area Modules (R.C.A.) - the VRP project has developed 15 instructional modules for staff development purposes. In addition, the project has developed

models, sample lessons, illustrations, reading guides, suggested practice exercises, and short articles to accompany the commercially developed materials selected for learning activities.

5. Instructional Materials System - the system was developed to provide teachers with information about, and access to, the wide variety of instructional resources available within their specific content area.

Implications for Basic Skills Project

The VRP project is the most highly developed reading program in the nation which deals with vocational as well as other content areas. Components of the VRP project are also essential elements of the Basic Skills project but the Basic Skills project extends itself to other areas of non-technical skills. Most of the VRP materials have been purchased by the project and will be reviewed for their possible inclusion in project guides. A project staff member has visited a VRP site in New York State to see VRP in action.

Summary of the Implications

Seven relevant research and development efforts on basic skills education and occupational education are identified in this chapter. These were selected from a vast amount of curricular and instructional materials available today. The Canadian generic communication and mathematics skills, derived from empirical studies, provide a broad perspective for the Basic Skills project. The extensive and detailed occupational analyses conducted by Ohio State and their further analysis by the Basic Skills project staff into distribution charts serve as extremely useful guides in developing instructional materials. The Minneapolis math/English skills vs. occupations charts provide examples of the occupational applications of concepts.

The Pennsylvania job-related mathematics skills survey can assist the project staff in finalizing the mathematical skills taxonomy since it

reports teachers' perceptions of skills importance. The series of HumRRO studies in functional literacy generated vast amounts of instructional material that can be used in our Resource and Teacher Guides. In addition, the simplified FORCAST readability analysis formula has great potential for use by vocational educators in assessing readability of technical publications and brochures that are commom to vocational programs.
The Vocational Reading Power project provides our project with an array of field tested instructional guides. It is evident that outcomes associated with the literature/material search described in this section will provide a firm basis for the production of Resource and Teacher Guides.

CHAPTER THREE

INSTRUCTIONAL MATERIALS

The final major task of the literature search was to identify instructional materials. The instructional materials identified fall into two categories. One category covers those texts which are significant and/or dominate the vocational commercial scene, the other category covers those basic skills materials relevant to vocational education. From among these materials, recommendations will be made to secondary level teachers to assist them in providing basic skills instruction to their students.

Procedures

Major steps were taken to assure the comprehensiveness of the literature search for instructional materials. These steps included the following:

1. The use of a full range of descriptors in the ERIC data base and CRIS data base searches.
2. The use of National Advisory Committee and Cornell Faculty Advisory Committee members and other experts to identify key relevant instructional materials for incorporating basic skills instruction into vocational curricula.
3. Search of relevant agency and professional organization bulletins, journals, monographs, etc., to identify relevant descriptive and research literature.
4. Search of final reports of known projects, such as project FLIT, project ABLE and JDRP approved projects.
5. Search of catalogues/lists from commercial publishers, R & D centers, curriculum networks and instructional materials laboratories for relevant instructional materials.
6. Telephone contacts (used extensively), personal interviews with vocational basic skills educators to ascertain current status and recent innovations on the infusion of basic skills instruction into vocational education programs.

The results of implementing these steps are discussed in the following sections of this report beginning with the commercially dominant texts.

Significant and/or Dominant Vocational Texts

Due to time and human resource limitations, the instructional materials data base only contains texts from major vocational subject publishers. Audio-visual as well as other types of materials are not included in this version of the list, since they do not have as wide a distribution as texts. The list only contains texts that are significant and/or dominant in their fields of specialization. "Significant" is defined as having at least 20% of the market for which a text is supposed to be used. "Dominant" is defined as having at least 50% of the market for which a text is supposed to be used.

The following set of procedures was followed in compiling the vocational instructional source data base presented in Appendix D.

1. Telephone survey of opinion leaders, especially prominent textbook writers and instructional material specialists in vocational education for information on what are the most widely used texts/references in their respective occupational instruction areas.
2. Survey of Editors-in-Chief and/or marketing managers of major vocational instructional textbook publishers for information regarding the books of their respective firms having a "significant" or "dominant" sales record in the field.
3. Telephone or written communication with major vocational instructional materials centers in the country for a list of the most used/sold curricular materials in each of the seven vocational areas.
4. Synthesis of the above information from various sources and compilation of an initial list of "significant" and/or "dominant" texts for each of the seven vocational areas.

It is recommended that the texts be selected from the list in a way that is compatible with the instructional programs that have been identified for their importance in terms of high secondary enrollment. To improve the validity of the list, it is further recommended that teachers be used to verify, add, or delete references based on their first-hand knowledge of currently used materials.

ERIC and CRIS Data Base Sources

Figure 9 lists the methods used to gather references relevant to our project from ERIC and CRIS data bases. The results of this effort may be found in Appendix E. The references cited are organized under two headings. The first heading covers those references related to multi-occupational areas. The second heading covers references related to specific occupation areas. Under this heading are listed titles related to such areas as Agriculture Education, Occupational Home Economics, and Trade and Industry.

The references identified through the ERIC and CRIS data base searches will be used to locate instructional and assessment materials and techniques which can be recommended to teachers. These references together with those found through the review of other sources of basic skills materials will be invaluable in the development of the project's Resource and Teacher Guides.

Basic Skills Materials

The objectives of this sub-task are to provide a data base for:

1. the identification of "how-to" examples for teaching basic skills to be used in the teacher guides.
2. the development of basic skills/vocational program matrices.

3. the development of a specialized job-related vocabulary list in each of the vocational areas.
4. the identification of testing materials that are built into vocationally related basic skills texts.
5. the identification of options of integrating instruction in basic skills into vocational programs.

Catalogues from major commercial publishers and instructional materials networks were searched in order to realize the above objectives. The list of references identified appears in Appendix F. The list will be updated as new sources are identified. The materials selected from the list will be those which are relevant to the instructional programs identified as the most important in terms of enrollment.

Implications

The list of significant and/or dominant texts available from commercial publishers provides a basis for the development of a series of specialized job-related vocabularies for different occupational areas. In addition, this list (Appendix D) and the basic skills materials list (Appendix F) can be combined to provide the project with comprehensive resources for the identification of essential basic skills and for the validation of readability analyses of printed vocational instructional materials. The development of basic skills/vocational program matrices may also be accomplished using the references listed. The ERIC, CRIS and basic skills materials searches will help us to identify occupationally relevant assessment instruments, instructional materials, and evaluation methods.

Taken together, the results of the Literature Search (Task E) form a firm foundation for the development of the project's Resource and Teacher Guides.

Figure 9

METHOD FOR SELECTING PROJECT RELEVANT REFERENCES
FROM ERIC AND CRIS DATA BASES

Span of Coverage: ERIC Data Base--up to December 1979
CRIS Data Base--1975 to December 1979

Descriptors used in the Search: Four sets of descriptors were used.

A. Level of Instruction--Tenth, Eleventh, Twelfth Grades

B. Vocational Areas--Agricultural Education
Business and Office Education
Distributive Education
Occupational Home-Economics Education
Health Occupations Education
Technical Education
Trade and Industrial Education
Vocational Education

C. Basic Skills-- Reading Improvement
Basic Skills, writing skills
Basic vocabulary, study skills
Language skills, vocabulary
Speech skills, listening
Verbal ability, comprehension
Arithmetic, communication skills

D. Type of Schools-- High Schools, secondary education
Senior high school secondary grades
Vocational high schools

Printouts: Separate printout for each of the seven vocational service areas and one additional printout for vocational education in general.

Selections: Part I--References related to multi-occupational areas
Part II--References related to specific occupational areas
(please see Appendix E)

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Strank, Edward J. and Speck, Samuel R. Analysis of the Auto Body Repair Occupation. Columbus, OH: Trade and Industrial Instructional Materials Laboratory, The Ohio State University, 1974. (This is one of an extensive series of booklets reporting analyses of many occupations.)

APPENDICES

Appendix A

ENROLLMENT OF VOCATIONAL EDUCATION PROGRAMS AND PROJECTED ANNUAL AVERAGE OPENINGS

USOE CODE	Instructional Program Title	Enrollment 1978* Secondary	Enrollment 1978* Total	Completions 1978*	1978-90 Projected Ann. Avg. Openings**	SEDI	GI
01.	Agriculture Total	715,272	1,006,542	181,014			
01.0100	Ag. Prod.	341,399	528,946	80,459		0.65	
01.0200	Ag. Supplies/Bus. Serv.	23,846	33,022	9,383			
01.0300	Ag. Mechanics	108,634	133,576	34,457	3,500[1]	0.81	
01.0400	Ag. Products	8,974	12,680	3,481			
01.0500	Ag. Ornamental Horticul.	83,923	130,836	32,765		0.64	
01.0600	Ag. Resources	17,253	24,517	6,923	900[2]		
01.0700	Forestry	17,822	22,382	4,639	1,400		
01.9900	Other	113,421	120,583	8,907			
04.	Distributive Total	397,429	962,009	279,720			
04.0100	Advertsng. Serv.	5,836	17,760	4,243	10,750[3]		
04.0200	Apparel & Acces.	21,273	32,012	11,821		0.66	
04.0300	Automotive	7,010	9,050	3,923	18,900		
04.0400	Finance & Credit	3,206	48,745	10,419	33,500		
04.0500	Floristry	2,246	7,767	2,267	4,200		
04.0600	Food Distrib.	26,307	37,117	18,990			
04.0700	Food Services	34,493	57,277	21,661		0.60	
04.0800	General Merchand.	178,684	284,230	108,484	470,000	0.63	4.33
04.0900	Hdwe., Bldg. Mtls., etc.	4,324	4,837	2,527			
04.1000	Home Furnishings	2,371	4,433	1,724			
04.1100	Hotel & Lodging	2,540	19,276	3,495	14,900		
04.1200	Industrial Mktg.	2,260	22,012	3,769	21,700		
04.1300	Insurance	773	16,773	2,875	40,250		
04.1400	International Trade	181	1,096	337			
04.1500	Personal Serv.	7,547	19,314	5,421			
04.1600	Petroleum	3,933	4,318	2,117	5,200		
04.1700	Real Estate	4,287	194,365	37,855	50,000		
04.1800	Rec. & Tourism	4,451	26,860	6,418			
04.1900	Transportation	4,124	17,069	4,164	14,700		

USOE CODE	Instructional Program Title	Enrollment 1978 Secondary	Enrollment 1978 Total	Completions 1978	1978-90 Projected Ann. Avg. Openings	SEDI	GI
04.2000	Ret. Trade, Other	15,865	23,524	7,879			
04.3100	Wholesale, Trade, Other	3,088	4,500	1,692			
04.9900	Other	62,630	109,672	17,639			
07.	Health Total	131,907	758,808	202,061			
07.0101	Dental Assistant	8,085	21,724	8,013	11,000	0.37	1.37
07.0102	Dental Hygienist (Assoc.)	119	7,465	2,360	6,000		
07.0103	Dental Lb. Tech.	911	4,185	1,234	2,800		
07.0199	Other Dental	558	1,251	516			
07.0203	Med. Lab. Assist.	3,941	17,988	3,894	14,800		
07.0299	Other Med. Lab. Tech.	546	5,464	1,329			
07.0301	Nursing, Assoc. Degree	572	115,940	24,895	85,000		
07.0302	Prac. (Voc.) Nurs.	8,424	94,874	34,399	60,000		
07.0303	Nurs. Asst. (Aide)	34,650	117,495	42,325	94,000	0.30	2.22
07.0305	Surgical Tech.	212	3,895	1,381	2,600		
07.0399	Other Nursing	5,433	49,386	7,003			
07.0401	Occupa. Therapy	138	2,531	820	1,100		
07.0402	Physical Therapy	580	3,310	854	400		
07.0499	Other Rehab.	447	2,819	421			
07.0501	Radiologic Tech.	301	10,983	3,090	9,000		
07.0503	Nuclear Med. Tech.	13	343	88			
07.0599	Other Radiologic	19	317	51			
07.0600	Ophthalmic	124	2,758	577	3,800[4]		
07.0700	Environ. Health	330	4,049	230			
07.0800	Mental Health Tech.	504	14,837	2,807			
07.0903	Ihal. Therapy Tech.	343	14,008	3,168	5,000		
07.0904	Medical Assistant	11,841	31,973	10,288		0.37	
07.0906	Health Aide	10,541	15,699	5,217			
07.0907	Med. Emerg. Tech.	989	88,092	23,748			
07.0909	Mortuary Scien.	57	1,513	307	2,200		
07.9900	Other	42,229	125,909	23,046			

USOE CODE	Instructional Program Title	Enrollment 1978 Secondary	Enrollment 1978 Total	Completions 1978	1978-90 Projected Ann. Avg. Openings	SEDI	GI
09.01	Consumer & Hmkg. Total	2,795,949	3,659,441	0			
09.0101	Compreh. Hmkg.	1,295,177	1,434,941	0			
09.0102	Child Devel.	170,251	260,252	0			
09.0103	Clothing & Tex.	198,179	365,456	0			
09.0104	Consumer Ed.	103,171	185,805	0			
09.0106	Family Rel.	211,124	264,117	0			
09.0107	Food & Nutri	302,399	427,769	0			
09.0108	Home Mgt.	38,923	52,682	0			
09.0109	Housing & Home Furnishing	92,664	161,567	0			
09.0199	Other	384,061	506,852	0			
09.02	Occup. Home Ec. Total	252,566	459,590	112,680			
09.0201	Care & Guid. of Child.	64,442	153,478	36,487	45,000[5]	0.42	
09.0202	Cloth. Mgt., Prod., Serv.	41,791	70,807	17,767		0.68	
09.0203	Food Mgt., Prod., Serv.	102,526	151,134	41,578		0.70	
09.0204	Home Furn., Equip., Serv.	6,174	29,222	5,243			
09.0205	Inst. & Home Mgt.	7,930	17,753	4,686	2,000		
09.0299	Other	29,703	37,198	6,919			
14.	Office Occup. Total	1,934,722	3,312,475	728,189			
14.0100	Acctg. & Comptg.	307,126	588,971	119,569	286,500[6]	0.52	2.40
14.0201	Computer & Console Oper.	18,512	50,666	11,519	12,500		
14.0203	Programmers	22,489	83,479	11,165	9,200		
14.0299	Other Bus., Data Process.	29,495	84,015	22,915			
14.0300	Filing, Office Machines	551,883	719,267	174,592	40,000[7]	0.77	
14.0400	Info. Communic. Occup.	17,035	45,400	11,144	35,550[8]		
14.0500	Mtls., Support, Trans.,	2,711	4,198	991	45,000[9]		
14.0600	Personnel, Trg. & related	16,928	58,717	14,858	17,000[10]		
14.0700	Steno, Secy. & related	389,787	700,586	170,167	305,000	0.56	1.79
14.0800	Supervsy. & Adm. Mgt.	18,264	212,792	29,078	2,200[11]		
14.0900	Typing & related	419,273	584,247	144,077	59,000	0.72	0.41
14.9900	Other	141,219	180,137	18,114	4,600[12]		

USOE CODE	Instructional Program Title	Enrollment 1978 Secondary	Enrollment 1978 Total	Completions 1978	1978-90 Projected Ann. Avg. Openings	SEDI	GI
16.	Technical Total	39,273	527,681	94,305			
16.0100	Science & Eng. Technicians				23,400		
16.0101	Aeronaut. Tech.	1,083	5,591	1,041			
16.0103	Architec. Tech.	3,228	30,660	4,910			
16.0104	Auto Tech.	1,101	14,041	2,354			
16.0105	Chemical Tech.	995	5,492	896			
16.0106	Civil Tech.	968	30,100	3,701			
16.0107	Electrical Tech.	4,120	25,032	2,607			
16.0108	Electronic Tech.	9,048	90,306	17,216	5,400	0.10	0.31
16.0109	Electro-mechnl. Tech.	342	4,298	971			
16.0110	Environ. Cntrl. Tech.	356	8,612	1,639			
16.0111	Industrl. Tech.	361	18,056	2,183			
16.0112	Instrumntn. Tech.	296	3,681	645			
16.0113	Mechanical Tech.	1,351	30,168	5,173			
16.0114	Metalurgical Tech.	84	1,529	524			
16.0117	Scientific Data Tech.	3,465	15,887	4,848			
16.0601	Commercial Pilot Trng.	136	8,874	1,325	3,800		
16.0602	Fire & Fire Safety Tech.	525	29,147	3,615			
16.0603	Forestry Tech.	138	3,292	543			
16.0604	Oceanographic Tech.	88	2,709	362			
16.0605	Police Science	2,665	105,457	18,511			
16.9901	Air Poll. Tech.	17	183	9			
16.9902	Water & Waste Water Tech.	48	7,254	551			
16.9900	Other	8,858	87,312	20,675			
17.	T & I Total	1,469,828	3,402,722	856,388			
17.0100	Air Conditioning	22,065	79,357	18,272	8,200		
17.0200	Appl. Repair	13,344	19,758	5,948	6,900		
17.0301	Body & Fndr.	49,879	93,339	29,401	9,800	0.53	0.33
17.0302	Auto Mech.	210,300	340,686	99,528	37,000	0.62	0.37
17.0399	Other Automotive	59,014	108,980	26,782			
17.0400	Aviation Occup.	9,293	36,814	6,459	4,200[13]		
17.0500	Blueprint Rdg.	1,387	16,856	2,892			
17.0600	Bus. Mch. Mnt.	3,962	1,511	1,217	4,200		
17.0700	Comrcl. Art Occ.	20,854	52,966	10,975	4,150[14]		
17.0800	Comrcl. Fishry. Occ.	-	7,108	1,135	450[15]		
17.0900	Comrcl. Phtgy.	10,863	40,185	7,960	2,700		
17.1001	Carpentry	97,359	162,213	44,625	58,000	0.60	1.30
17.1002	Electricity	36,629	95,382	18,373	13,600		
17.1004	Masonry	26,055	44,723	11,891	8,000		
17.1007	Plmbg. & Pftng.	9,349	43,995	8,312	20,000		
17.1099	Other Constr./Mat.	73,278	130,991	32,133	72,100		

USOE CODE	Instructional Program Title	Enrollment 1978 Secondary	Enrollment 1978 Total	Completions 1978	1978-90 Projected Ann. Avg. Openings	SEDI	GI
17.1100	Catal. Serv.	9,875	19,895	5,406	176,000		
17.1200	Diesel Mech.	7,448	25,859	7,303			
17.1300	Drftg. Occ.	97,151	152,327	33,294	11,000	0.64	0.33
17.1400	Elctrl. Occ.	30,065	118,022	24,349	16,550[16]		
17.1500	Eltrnc. Occ.	72,040	146,294	35,217	10,000[17]	0.49	
17.1600	Fabric Mnt. Serv.	1,679	2,865	701			
17.1700	Mgt. Development	1,521	76,014	18,650	69,000		
17.1900	Grphc. Arts Occ.	77,798	108,584	26,920	13,950[18]	0.72	
17.2000	Indstrl. Ato. Engy.	312	582	114			
17.2100	Instr. Mnt. & Rep.	929	4,547	913			
17.2200	Maritime Occ.	2,472	9,096	1,103	1,000		
17.2302	Machine Shop	56,646	117,069	32,588	44,035	0.48	1.35
17.2303	Machine Tool Oper.	5,269	14,232	3,437			
17.2305	Sheet Metal	20,017	45,694	6,571	3,500		
17.2306	Welding & Cutng.	56,759	205,486	51,722	35,000	0.28	0.68
17.2307	Tool & Die Mkg.	806	8,475	2,396	10,400		
17.2399	Other Mekwrkg. Occ.	44,862	58,709	17,548	3,100		
17.2400	Mtlrgy. Occ.	1,257	4,213	480	35,000		
17.2601	Barbering	1,033	4,184	1,044	9,700		
17.2602	Cosmetology	64,613	97,947	27,215	28,500	0.66	1.05
17.2699	Other Prsnl. Serv.	44,597	7,608	2,118			
17.2700	Plastics Occup.	4,597	7,608	1,943			
17.2801	Firefighter Trng.	1,811	186,472	78,542	7,500		
17.2802	Law Enforcmt. Trng.	3,930	104,194	21,744	88,300		
17.2899	Other Pub. Serv.	4,980	66,991	7,346	8,000		
17.2900	Qty. Food Occ.	29,254	54,468	14,389	195,200[19]	0.54	13.57
17.3000	Refrigeration	8,973	2,243	2,260			
17.3100	Small Eng. Rep.	29,126	52,524	13,171			
17.3200	Stn. Engy. Src.	1,588	14,021	3,639	105,000		
17.3300	Textile Prod. & Fabric.	17,149	45,642	12,755			
17.3400	Leather Wrkg.	1,183	1,930	677	1,600[20]		
17.3500	Upholstering	5,310	22,136	7,198	1,100		
17.3600	Woodworking Occ.	59,336	89,620	17,653		0.66	—
17.9900	Other	109,861	243,529	50,059			
99.	Special Programs Total	3,223,774	3,509,351	0			
99.0100	Grp. Guid. (Pre-Vocat.)	1,455,126	1,508,189	0			
99.0300	Remedial	48,858	101,904	0			
99.0400	Industrial Arts	1,479,121	1,492,790	0			
99.0600	Other N.E.C.	240,669	406,468	0			

* Summary Data - Vocational Education, Program Year 1978.
U. S. Department of Health, Education, and Welfare.

** Occupational Projections and Training Data, B-2058.
U. S. Department of Labor, 1980.

FOOTNOTES USOE CODE	Occupation	Annual Average Openings: Total 1978-90	
[1] 01.0301	farm equipment mechanics	3,500	
[2] 01.0607		700	sum = 900
01.0608	range managers	200	
[3] 04.0100	advertising services	not available	
[4] 07.0601	ophthalmic lab. technicians	2,600	sum = 3,800
07.0603	optometric assistants	1,200	
[5] 09.0201 09.0202 09.0203	private household workers	45,000	
09.0205	hotel housekeepers		
[6] 14.0102	bookkeeping workers	96,000	sum - 286,500
14.0103	cashiers	119,000	
14.0104	office machine operators	9,700	
14.0105	bank tellers	17,000	
14.1103			
14.1900		-200	
14.0102 14.0104 14.0303 14.0399	statistical clerks	45,000	
[7] 14.0302	file clerks	16,500	sum = 40,000
14.0303	statistical clerks	23,500	
[8] 14.0401	telephone operators	50	sum = 35,550
14.0403	postal clerks	2,000	
14.0406	receptionists	4,000	
14.0401	telegraphers, telephones, & tower operators	9,900	
14.0499	library technicians	12,600	

FOOTNOTES (continued)

USOE CODE	Occupation	Annual Average Openings: Total 1978-90	
[9]14.0503	shipping and receiving clerks	22,000	sum = 45,000
14.0504	stock clerks	23,000	
[10]14.0602 14.0603 14.0699	personnel and labor relations workers	17,000	
[11]14.0899	credit managers	2,200	
[12]14.9900	other	4,600	
04.0800	general merchandising		
[13]17.0403	air traffic controllers	700	sum = 4,200
17.0401	airplane mechanics	3,500	
[14]17.0703	industrial designers	550	sum = 4,150
17.0701	interior designers	3,600	
[15]17.0802	merchant marine officers	700	sum = 450
17.0801	merchant marine sailors	-250	
[16]17.1400	maintenance electricians	15,500	sum = 16,550
17.1402	signal department workers	1,050	
[17]17.1501	central officecraft occupations	3,900	sum = 10,000
17.1503	television and radio technicians	6,100	
[18]17.1906	bookbinders and bindery-workers	2,600	
17.1901	compositors	3,900	sum = 13,950
17.1902	lithographers	7,300	
17.1904	photoengravers	150	
[19]17.2902	cooks and chefs	86,000	
17.2903	meatcutters	5,200	sum = 195,200
17.2904	food counter workers	104,000	
[20]17.3402	shoe repairers	1,600	

Appendix B

PART 1

MATHEMATICS SKILLS AND CONCEPTS

A. Minds - Arabic numeral system

1. What is a number/numeral?
2. Place value/expanded notation
3. Compare and contrast various base number systems with our decimal numeral system (Binary, Octal, etc.).

B. Set of Real numbers

Reals

Irrational

Rationals

Fractions and Decimal Fractions

Proper

Improper

Integers

signed numbers

Whole numbers

Counting numbers

C. Uses of Numbers: (without calculation)

1. Counting
2. Coordinate system
3. Ordering
4. Indexing
5. Coding-given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal.
6. Ratio
7. Visual approximation
8. Rounding

D. Fundamental Operations (Calculation)

1. Addition algorithm
2. Subtraction algorithm
3. Multiplication algorithm
4. Division algorithm
5. Order of operations
6. Use of parentheses in simplifying arithmetic expressions.

Applicable

E. Basic Arithmetic Skills and Concepts

1. Reduction of fractions. (Example: 12/16 = 3/4)
2. Changing mixed numbers to improper fractions. (Example: 4 1/4 = 19/4)
3. Changing percents to fractions and fractions to percents.
4. Finding a percent of a number and what percent one number is of another.
5. Changing fractions to decimal and decimal to fractions
6. Ratio and proportion

Estimation

7. Rounding off decimals and whole numbers (Example: .4877 = .488 when rounding to three decimal places.)
8. Approximation using scientific notation (Example: 3.43 x 10^2 = 344)
9. Guess and check method
10. Rule of thumb (a pack's a pound, etc.)
11. Property of comparison
    a. equality/equivalence
    b. inequality/greater than/less than
12. Properties of the real number system
    a. commutative (order)
    b. associative (grouping)
    c. distributive (multiplication W.R.T. addition)
    d. identity of one (1)
    e. multiplication by zero (0)
    f. multiplication by zero
    g. transitive
    h. inverses/multiplicative and additive

F. Use of computing devices and mechanical aids

1. Slide rule
2. Calculators
    a. electric
    b. mechanical
3. Computers

G. Basic Measurement Skills and Concepts

1. "Measure sense"/role of "unit."
2. Instruments: ruler/compass/protractor/clinometer/tape clipers/micrometer/thermometer/barometer/tachometer and others.
3. Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
4. Metric and English measure and conversion.
5. Rate
6. Measurement: Geometric
    a. linear (Example: inches, feet, yards, etc.)
    b. area (Example: square measure)
    c. volume (Example: cubic measure
    d. angle (Example: degrees, minutes, seconds, etc.)
7. Measurement: Non-geometric
    a. time/calendar
    b. money/interest
    c. temperature
    d. weight
    e. liquid
    f. dry
    g. speed (Example: feet per minute, R.P.M. etc.)
8. Conversion from one standard unit to another (be specific)
9. Reading and interpreting tables, charts, and graphs
    a. Logs
    b. trig. functions
    c. scale drawings/floor plans/blueprints
    d. maps
    e. number line/coordinate graph (2 dimensional and 3 dimensional)
    f. representational graphs (Example: pictograph, bar, circle)

H. Basic Algebra Skills and Concepts

1. Uses of variables
    a. in formulas
    b. in equation
    c. in functions
    d. for stating axioms and properties
    e. as parameters
2. Expression of product in terms of its prime factors, numerical or monomial.
3. Manipulation formulas
   Examples: D = R T---D/R = D/T = R
4. Write as a formula equation a realtionship given in words
5. Substitute given values in order to find the value of the required unknown.
6. Solve problems involving numerical algebraic expressions. (Examples: -12 + 7 -6 (6-1) = -40.)
7. Solve problems involving literal algebraic expressions. (Examples: 12 = 7X - (6X - 1) = 12 = X.)
8. Use of exponents to indicate the power of a number. (Example: a^4 a^3 = a^7)

From T. Hinds, Personal Communication, April 7, 1980. The skills in these two lists are those used in the original occupational analyses which resulted in The Ohio State University task analyses illustrated in Figure 1 of this report.

9. Algebraic subtraction, multiplication and division of numerical and literal terms. (Example:
-4a subtracted from -8a = 12a
$-3a \times -4a = +12a$
$-a^6 \div -a^3 = -a^3$)

10. Algebraic multiplication of two monomials and polynomials with exponents. (Example: $-3a^2 \times -7\ ab^3 = 21\ a^{\frac{1}{2}}b^{\frac{1}{4}}$
$-3a^2 - 2\ ab \times -3ab = -6a^{\frac{1}{2}}b^2 + 4a^{\frac{1}{2}}b^2$ c)

11. Algebraic division of polynomials and monomials. (Example: $4a^{\frac{1}{2}}b^4 - 2\ a^{\frac{1}{2}}b^3$)

12. Solve simple algebraic and quadratic equations. (Example: $x - 3 = 12,\ x = 20$
$4x^2 = 16,\ x = \pm 2$)

13. Solve a set of simultaneous equations in two or more unknowns using substitution and elimination: (Example: +, -)

14. Understanding and Use of matrices.

Basic Geometry Skills and Concepts

1. Recognize and identify basic geometry figures, plane and solid.
2. Knowledge of geometric relationships
   a. symmetry
   b. congruence
   c. similarity
   d. parallel
   e. perpendicular
   f. skew
3. Understanding and use of the Pythagorean theorem, based on the right triangle. (Example: $a^2+b^2=c^2$)
4. Determination of area and altitude of triangles
5. Determination of area, perimeter and diagonals of polygons with more than 4 sides.
6. Determination of area and circumference of circles.
7. Use of area or cords in determining facts about a circle or its parts.
8. Determination of the area of rings.
9. Determination of facts involving centers of a circle.
10. Determination of area and perimeter of an ellipse.
11. Determination of facts involving lines tangent to circles.
12. Determination of area and volume of rectangular, cube and right triangular prisms.
13. Determination of area and volume of cylinders
14. Determination altitude, area and volume of a right circular cone.
15. Determination of lateral area, total area and volume of frustums of pyramids and cones.
16. Determination of the surface and volume of a sphere.
17. Determination of the volume of a ring.
18. Geometric constructions. (Example: Perpendiculars to lines, bisecting angles, finding the center of an arc, etc.)

Basic Trigonometry Skills and Concepts

1. Use of trigonometric functions in solution of problems involving right triangles.
2. Use of trigonometric functions in solution of problems involving equilateral triangles.
3. Use of trigonometric functions in the solution of problems involving the oblique triangles.

Basic Probability Skills and Concepts

1. Determine probability of simple events
2. Use of probability in prediction of mass behavior vs. unpredictability of single events.

Basic Statistical Skills and Concepts

1. Representative sampling from population.
2. Measurement of central tendency via mean (average), median, standard deviation.
3. Techniques of statistical analysis and statistical inference.

Basic Logic

1. Symbolism (, etc.)
2. Deductive/Inductive
3. Implications/Converse/Inverse/Contrapositive
4. Arguments/Tests for validity
5. Proof
   a. Direct

      Paragraph/two column

   b. Indirect

PART 2

COMMUNICATION SKILLS AND CONCEPTS

Performance	Knowledge of Concepts/Skills
A. Speaking	1. Terminology/General Vocabulary 2. Appropriate Diction 3. Inquiring 4. Enunciation 5. Clarity of Expression 6. Persuasion and Sales Techniques 7. Denotative/Connotative Words 8. Logic 9. Gestures 10. Drama 11. Facial and Body Features 12. Poise 13. Usage
B. Reading	1. Comprehension 2. Detail/Inference 3. Speed/Rate 4. Informational Reports 5. Recommendation Reports 6. Progress Reports 7. Physical Experiment Reports 8. Proposals 9. Description of Mechanism 10. Definition 11. Terminology
C. Writing	1. Penmanship 2. Spelling 3. Classification 4. Memo Format 5. Description 6. Reports (see above for types) 7. Business Letters (Format/Content) 8. Terminology/General Vocabulary 9. Appropriate Diction 10. Clarity of Expression 11. Persuasion and Sales Technique 12. Denotative/Connotative Words 13. Logic 14. Usage
D. Listening	1. Auditory Discrimination 2. Detection of Propaganda Devices 3. Discriminate Facts from Non-facts 4. Recognize Opinions 5. Concentration 6. Logic (Ordering of Thoughts and Ideas) 7. Word Definition 8. Note Taking 9. Noise Discrimination (Recognize proper and improper sounds: animal, human, machine
E. Viewing	1. Visual Analysis (Seeing the parts in relation of the whole. 2. Memory (Short & Long Term Retention) 3. Describing (Discrimination and Verbalization of Physical Characteristics) 4. Logic (Ordering of Thoughts and Perceptions) 5. Detail and Inference 6. Color Discrimination 7. Recognition of Symbols, Codes, Emblems
F. Touch	

Appendix C

BASIC SKILLS DISTRIBUTION CHARTS

Occupations

Automotive Body Mechanic
Bank Teller
Bindery
Bookkeeper
Childcare/Nursery School Teacher Aide
Data Accountant
Drafting Occupations
Garden Center Employee
Lithographic Printing Occupations
Offset Press Operator
Terminal Clark
Word Processor

BASIC SKILLS PROJECT

Automotive Body Mechanic

BASIC SKILLS DISTRIBUTION CHART

| TASK STATEMENTS | MATH | | | | | | | | | | | | | | | | COMMUNICATION | | | | | | | | | | | | | | | |

BASIC SKILLS PROJECT

Automotive Body Mechanic
Program - 17.0301

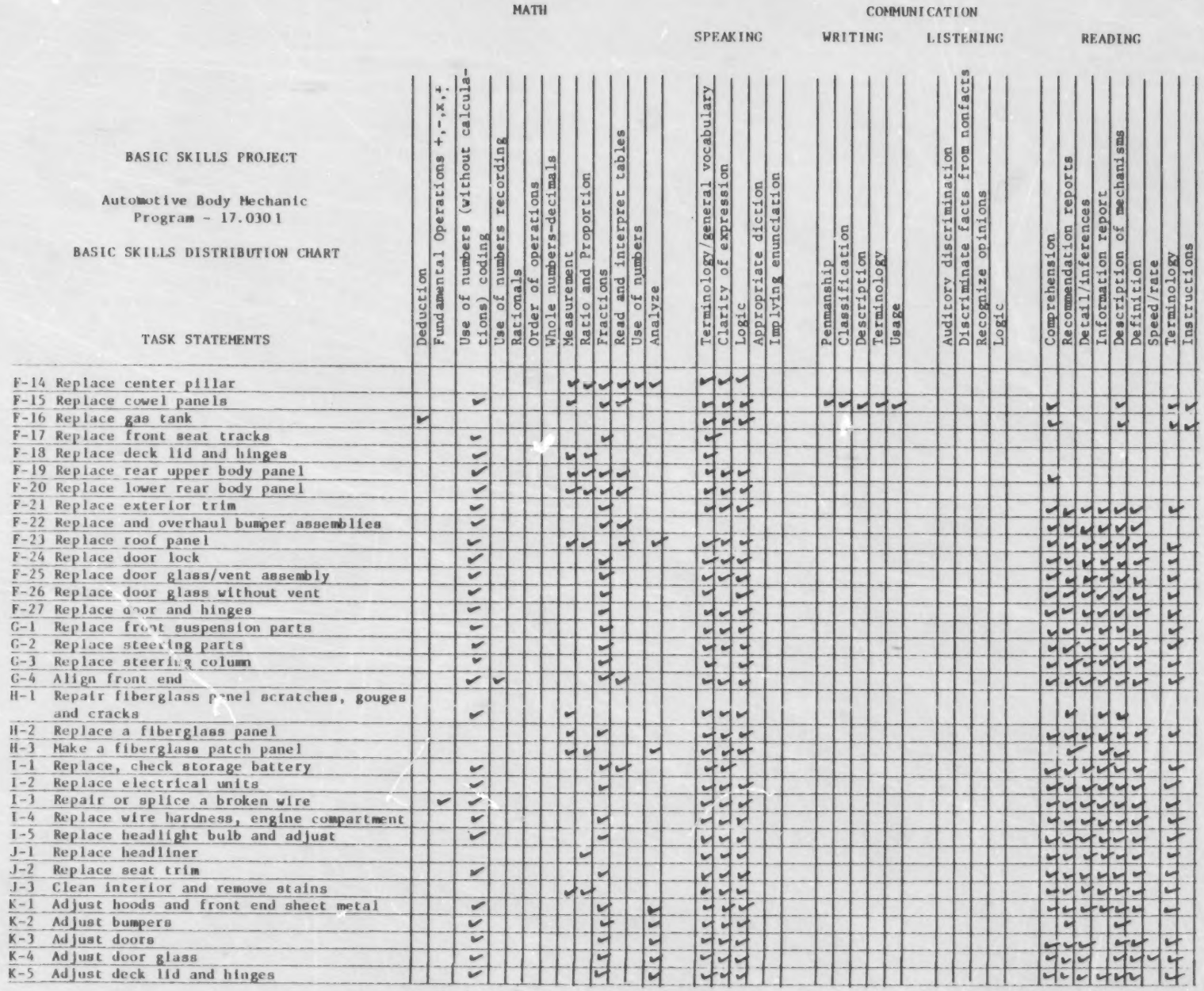
BASIC SKILLS DISTRIBUTION CHART

| TASK STATEMENTS | MATH | | | | | | | | | | COMMUNICATION | | | | | | | | | |

BASIC SKILLS PROJECT

Automotive Body Mechanic
Program - 17.0301

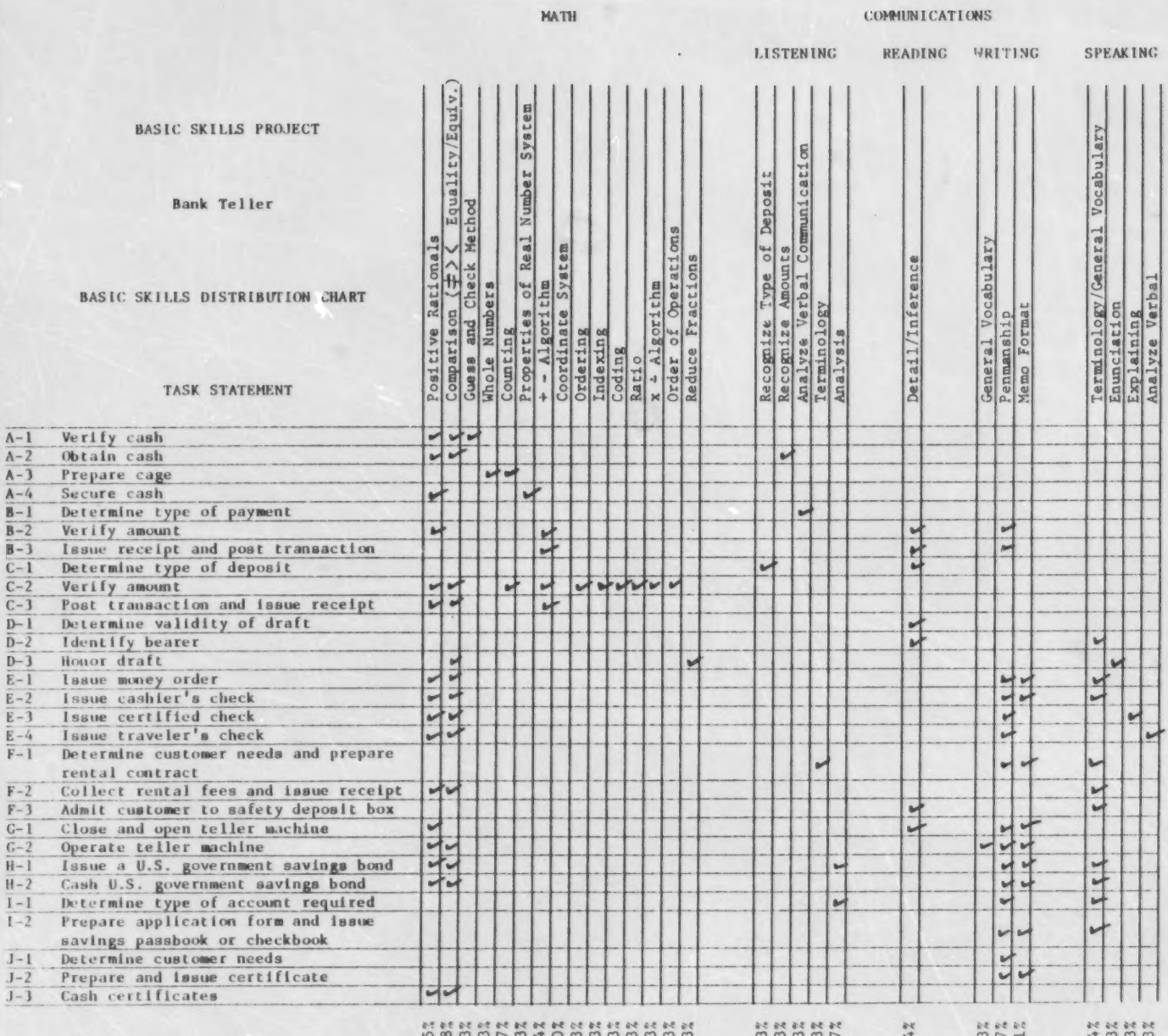
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Bank Teller

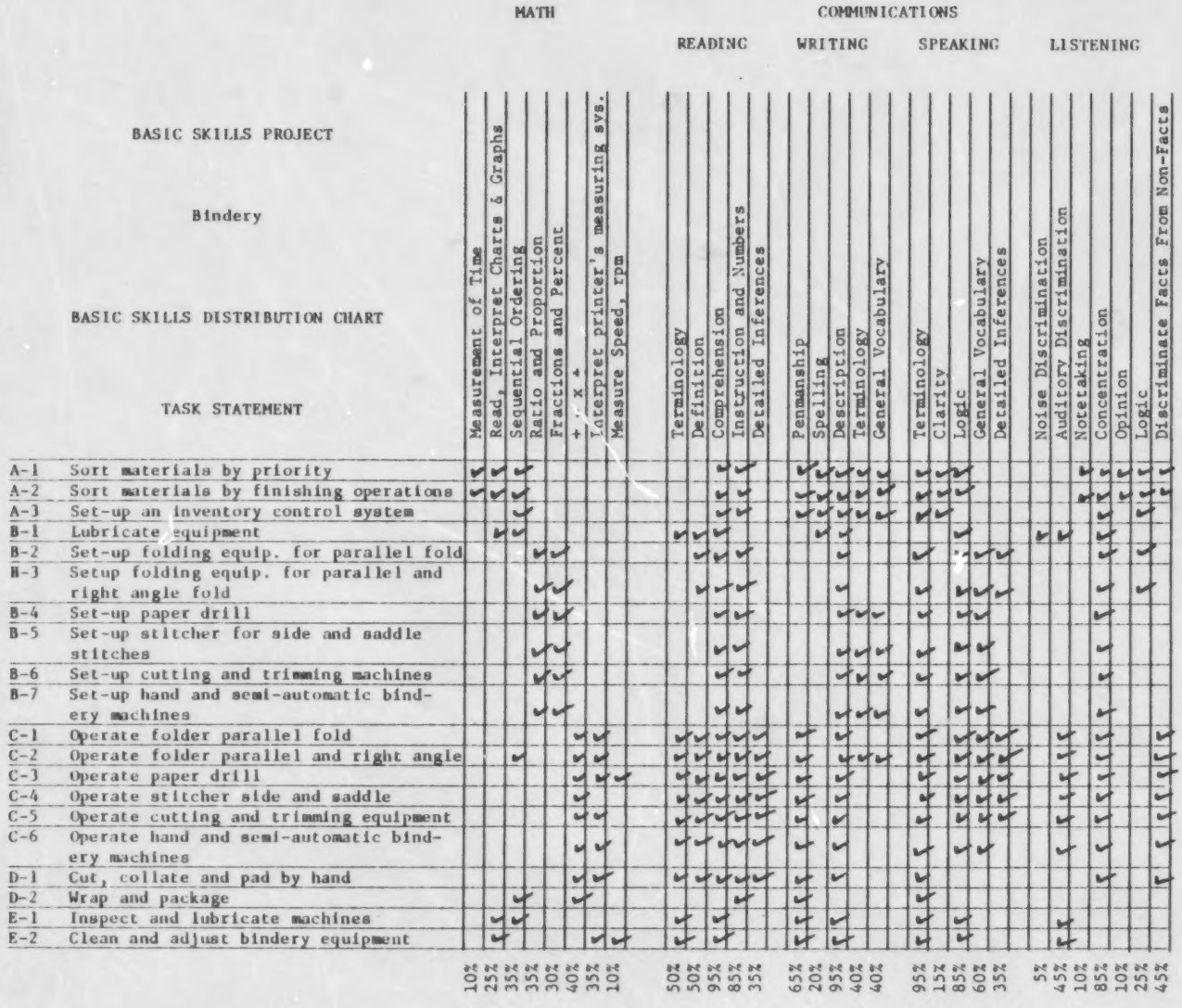
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Bindery

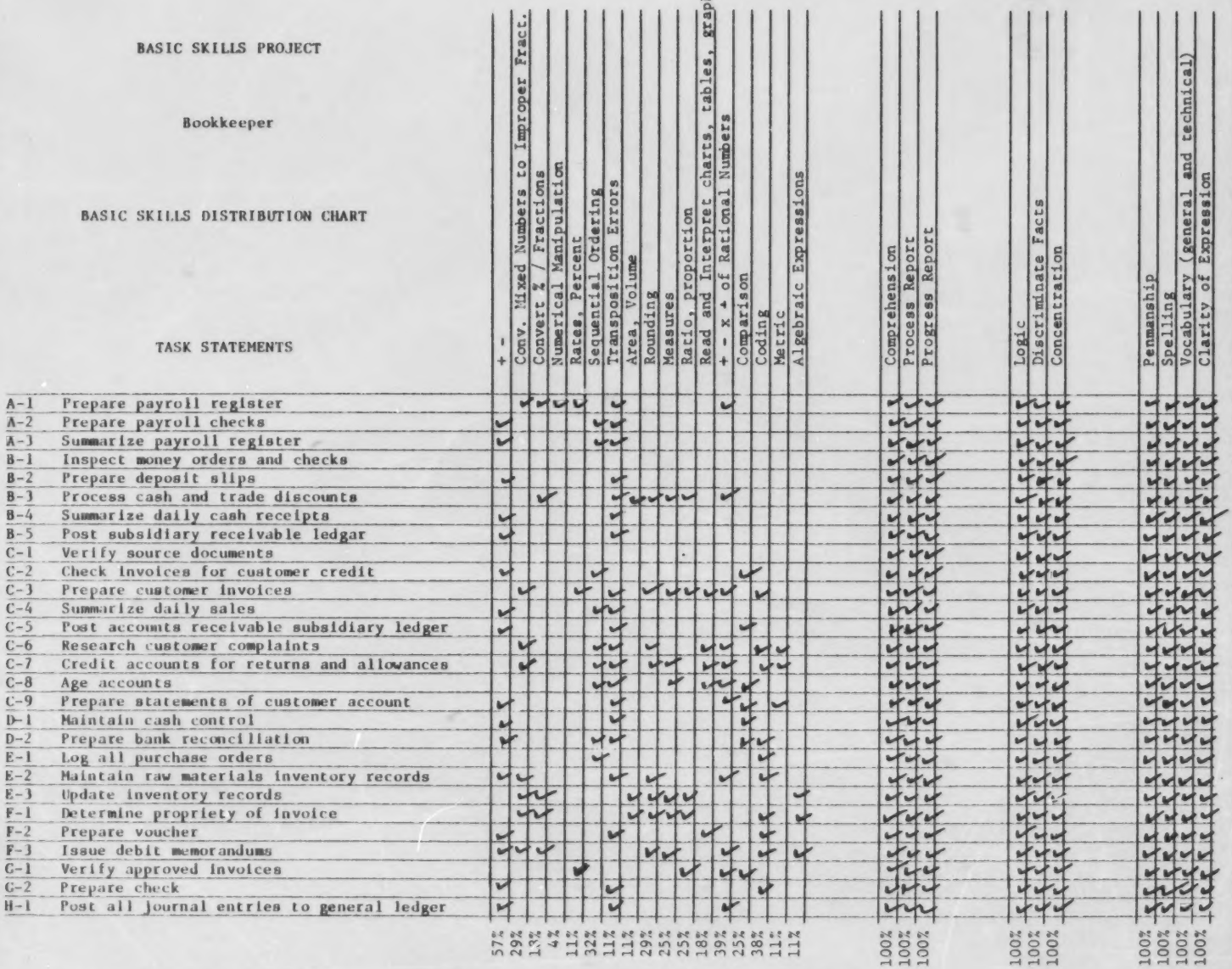
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Bookkeeper

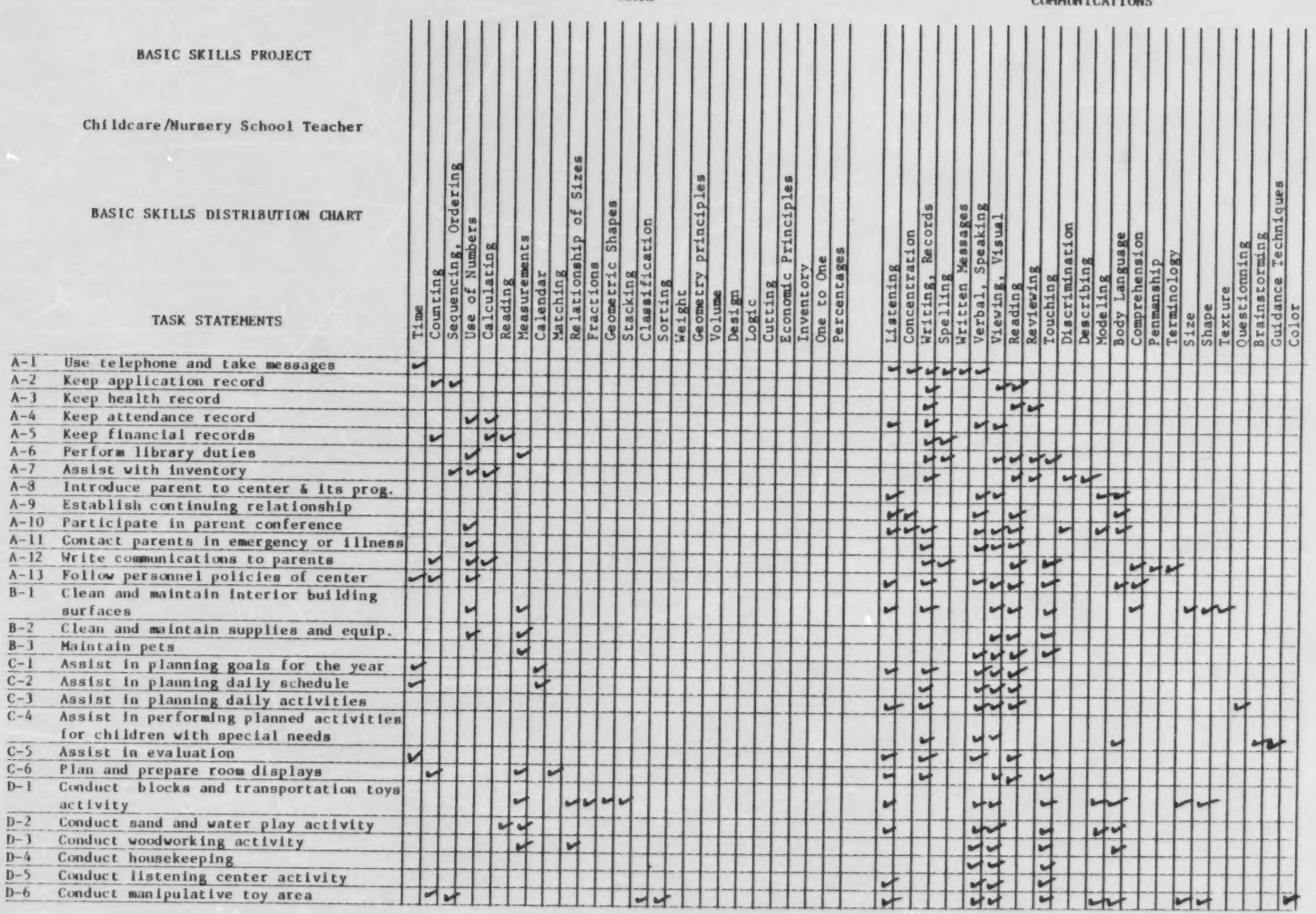
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Childcare/Nursery School Teacher

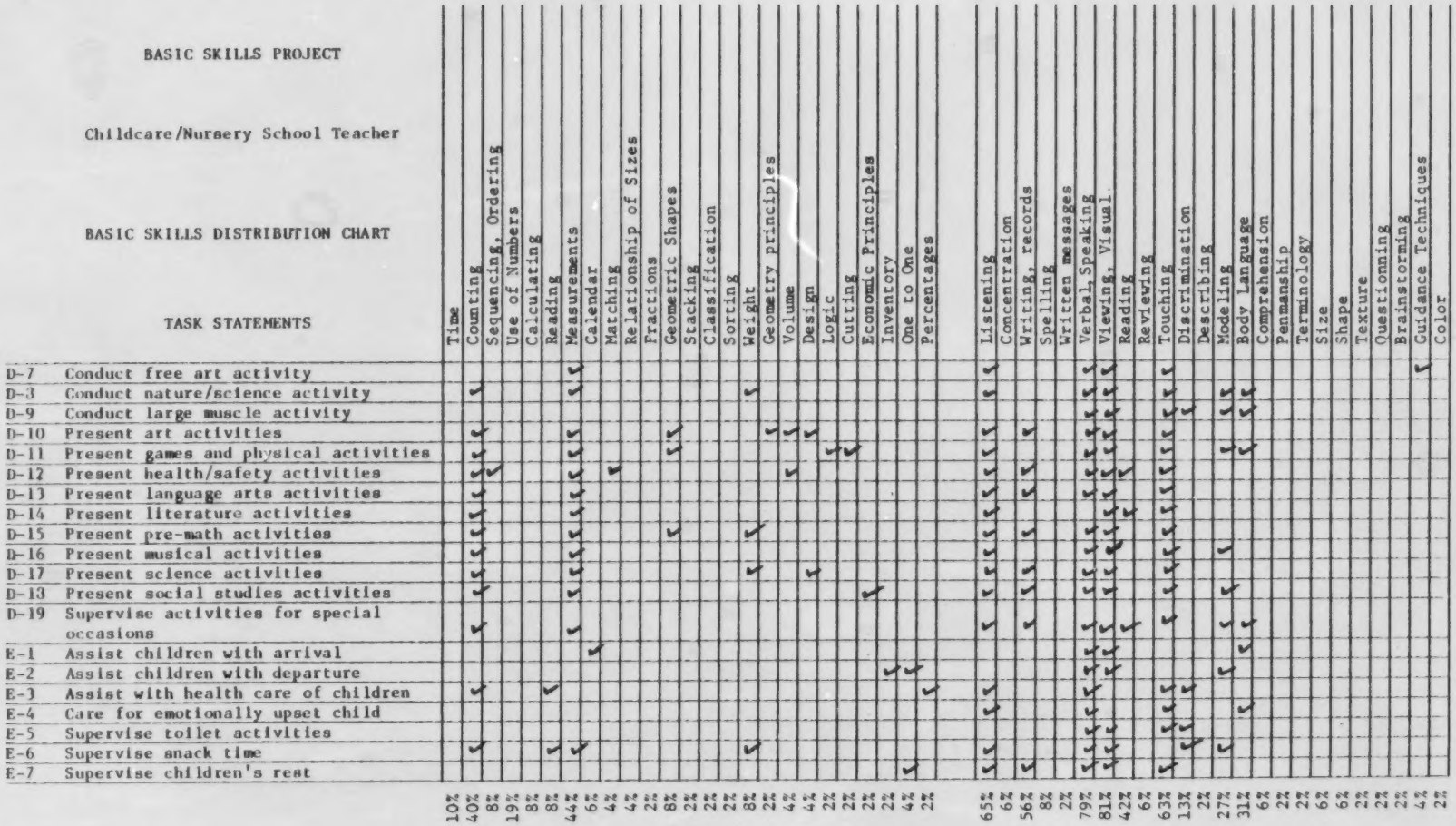
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Childcare/Nursery School Teacher

BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Data Accountant

BASIC SKILLS DISTRIBUTION CHART

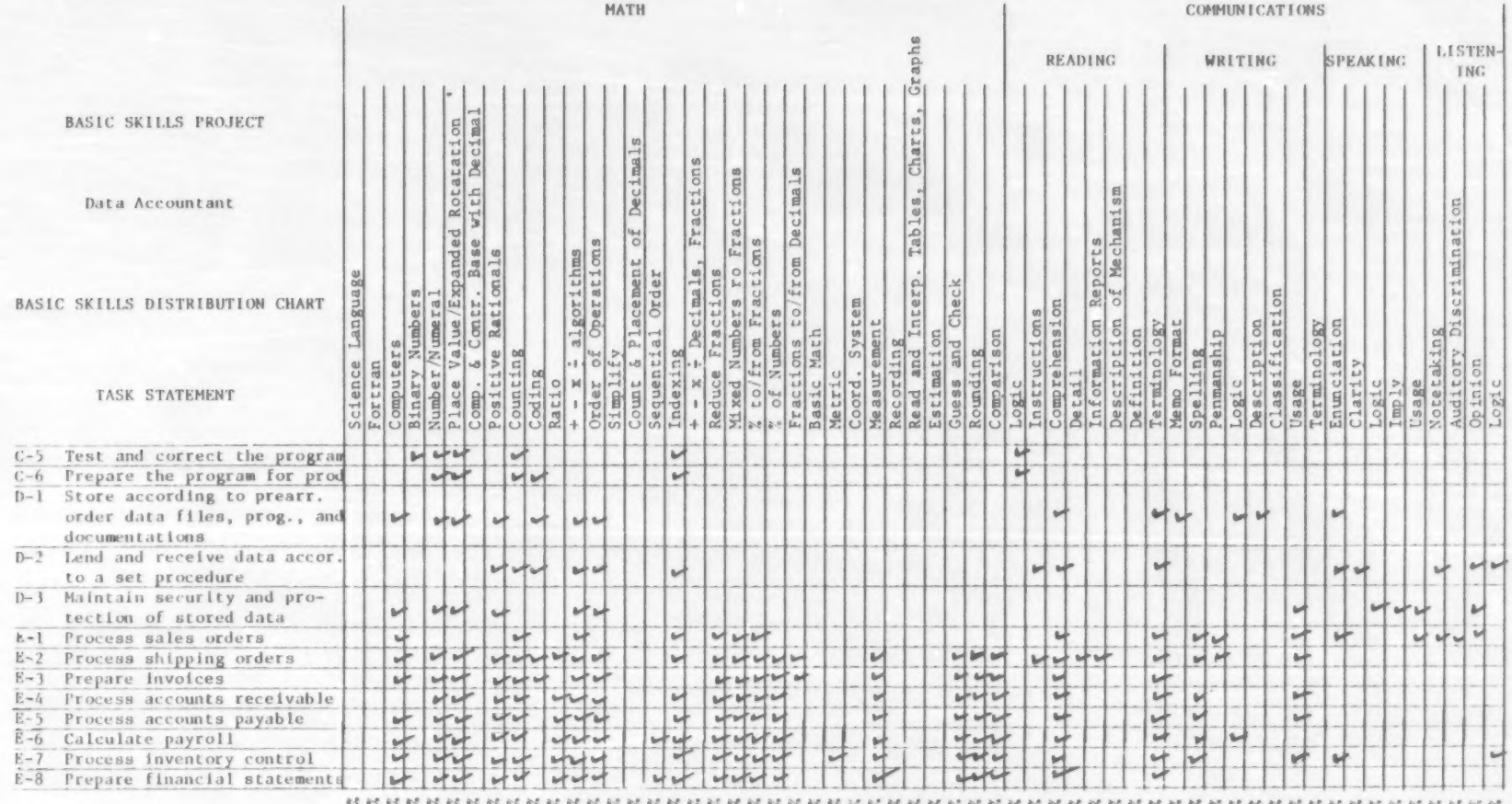
TASK STATEMENT

| TASK STATEMENT | MATH: Science Language | Fortran | Computers | Binary Numbers | Number/Numeral | Place Value/Expanded Notation | Comp. & Contr. Base with Decimal | Positive Rationals | Counting | Coding | Ratio | + - x ÷ algorithms | Order of Operations | Simplify | Count & Placement of Decimals | Sequential Order | Indexing | + - x ÷ Decimals, Fractions | Reduce Fractions | Mixed Numbers to Fractions | % to/from Fractions | % of Numbers | Fractions to/from Decimals | Basic Math | Metric | Coord. System | Measurement | Recording | Read and Interp. Tables, Charts, Graphs | Estimation | Guess and Check | Rounding | Comparison | COMMUNICATIONS: READING: Logic | Instructions | Comprehension | Detail | Information Reports | Description of Mechanism | Definition | Terminology | WRITING: Memo Format | Spelling | Penmanship | Logic | Description | Classification | Usage | Terminology | SPEAKING: Enunciation | Clarity | Logic | Imply | Usage | LISTENING: Notetaking | Auditory Discrimination | Opinion | Logic |
|---|---|---

BASIC SKILLS PROJECT

Data Accountant

BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Drafting Occupations

BASIC SKILLS DISTRIBUTION CHART

MATH

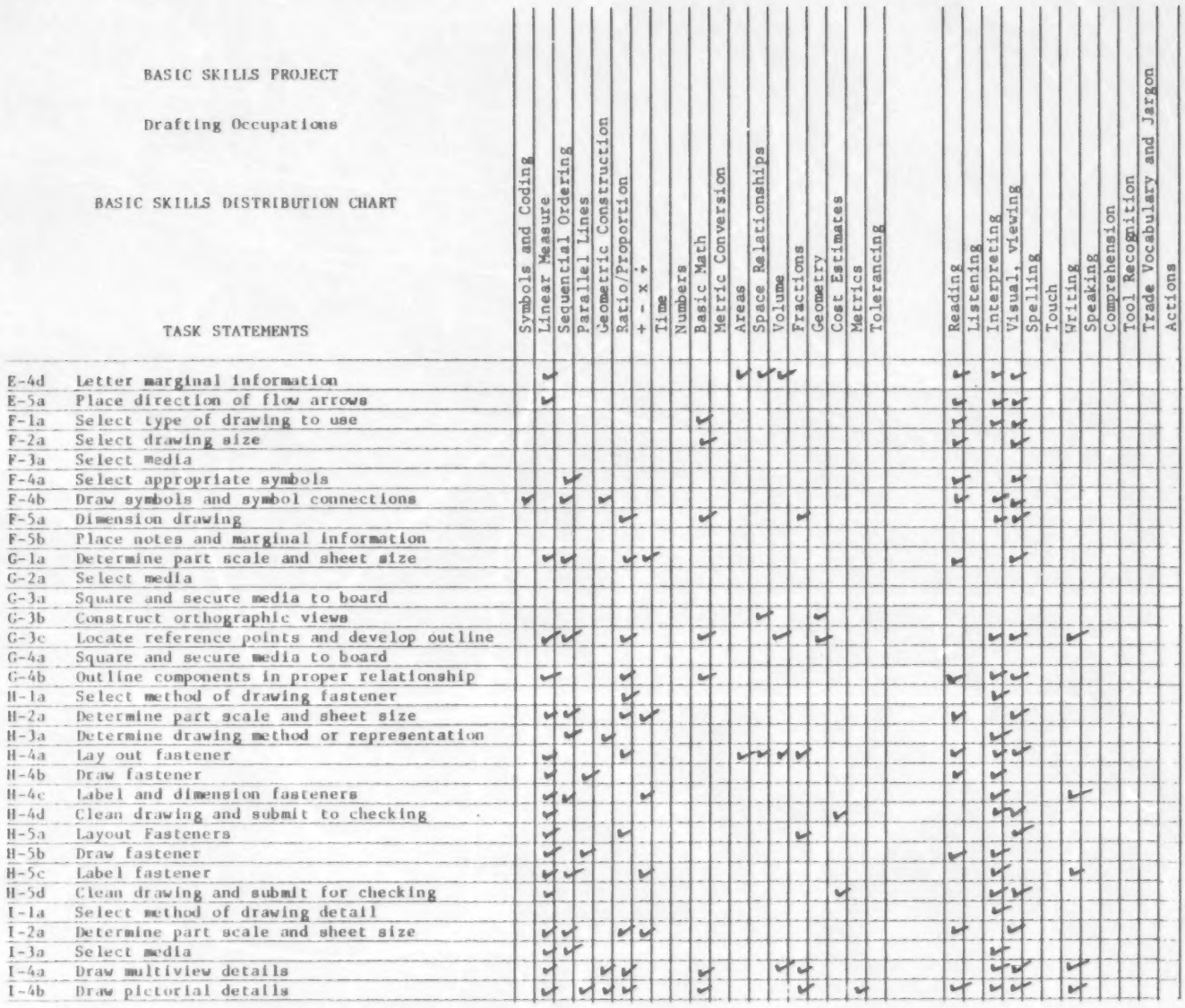
COMMUNICATIONS

TASK STATEMENTS		Symbols and Coding	Linear Measure	Sequential Ordering	Parallel Lines	Geometric Construction	Ratio/Proportion	+ - x ÷	Time	Numbers	Basic Math	Metric Conversion	Areas	Space Relationships	Volume	Fractions	Geometry	Cost Estimates	Metrics	Tolerancing	Reading	Listening	Interpreting	Visual, viewing	Spelling	Touch	Writing	Speaking	Comprehension	Tool Recognition	Trade Vocabulary and Jargon	Actions
A-1a	Prepare original to make tracing	✓																			✓	✓										
A-1b	Do line work		✓																													
A-2a	Select reproduction method		✓	✓																	✓											
A-3a	Prepare blueprint machine for operation		✓	✓				✓													✓	✓										
A-3b	Operate blueprint machine			✓				✓		✓												✓										
A-4a	Trim and bind prints																															
A-5a	Store drawings		✓	✓							✓										✓											
A-5b	Distribute prints																															
B-1a	Determine required space and location		✓	✓				✓		✓											✓											
B-1b	Stock and maintain inventory		✓					✓		✓											✓											
B-2a	Determine types of maintenance to perform											✓																				
B-2b	Clean and Lubricate tools and equipment																															
B-2c	Repair and adjust tools and equipment							✓			✓																					
B-3a	Install and adjust drafting machine	✓	✓	✓	✓																											
B-3b	Install and adjust parallel bar	✓	✓	✓	✓																											
B-3c	Install drawing board covers		✓	✓																												
B-3d	Adjust posture chair																															
C-1a	Select sketch type and sketch size		✓	✓	✓			✓				✓																				
C-2a	Select media																															
C-3a	Draw sketch						✓	✓																								
C-4b	Dimension and note sketch											✓	✓																			
D-1a	Determine column headings		✓	✓	✓			✓						✓							✓		✓									
D-2a	Select location of materials list																															
D-2b	Draw and letter materials list		✓	✓	✓			✓						✓							✓		✓									
D-3a	Placement of keys and legends	✓	✓																													
E-1a	Select scale and sheet size		✓	✓				✓		✓													✓	✓								
E-2a	Select media																															
E-3a	Locate start and finish points	✓	✓	✓																	✓		✓	✓								
E-4a	Prepare to draw																															
E-4b	Draw block diagram		✓	✓			✓																								✓	
E-4c	Letter blocks																															

BASIC SKILLS PROJECT

Drafting Occupations

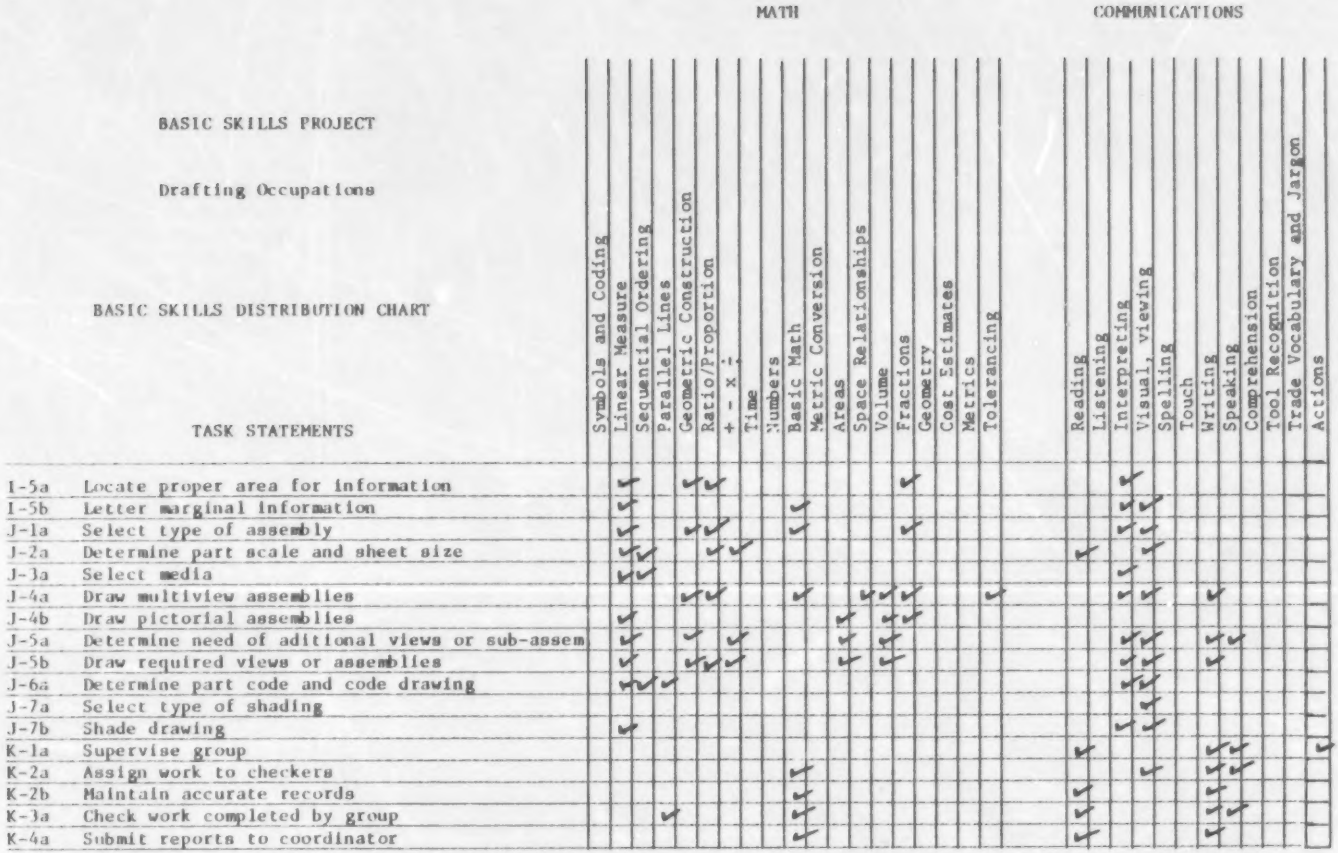
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Drafting Occupations

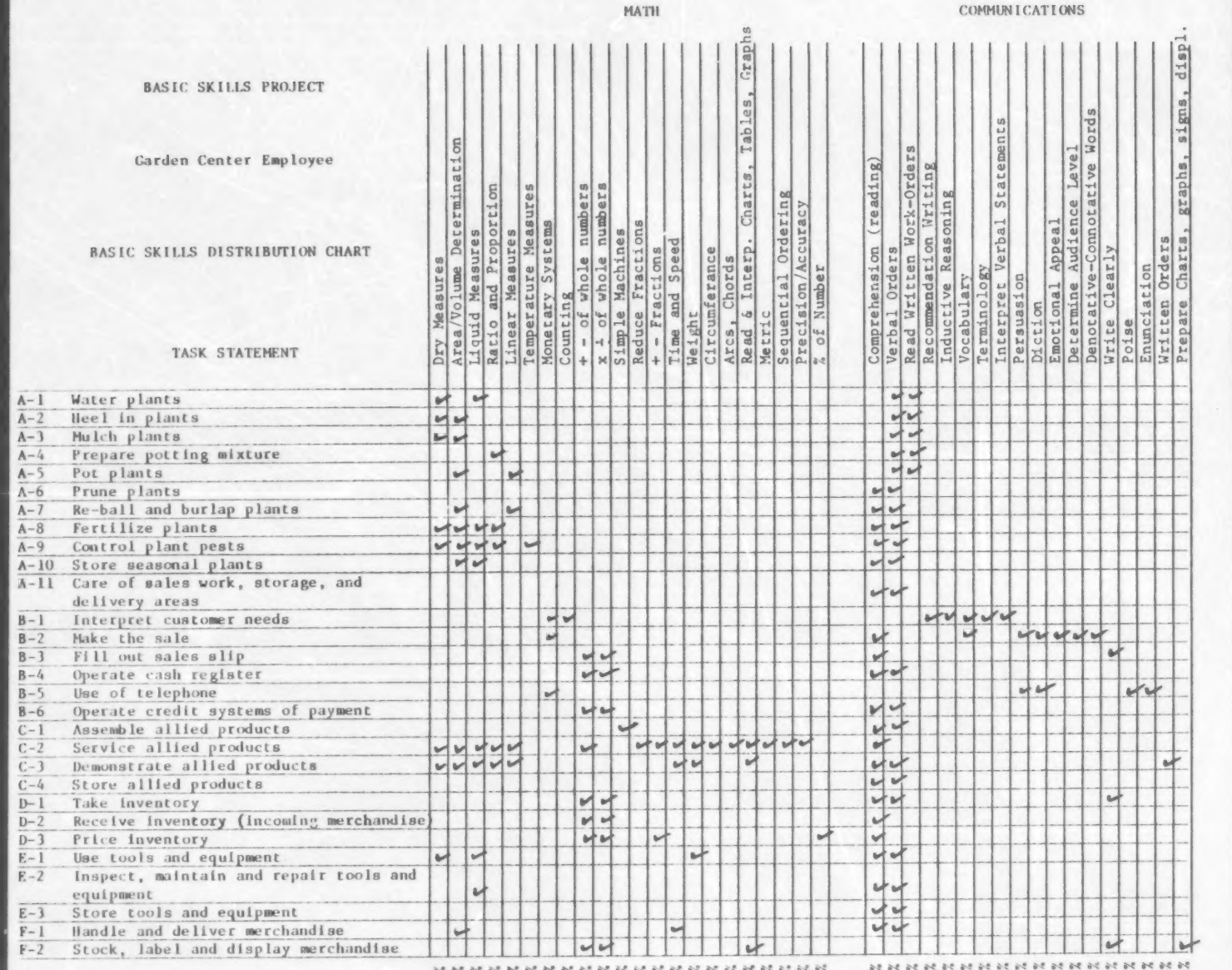
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Garden Center Employee

BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Lithographic Printing Occupations

BASIC SKILLS DISTRIBUTION CHART

	TASK STATEMENTS	MATH																COMMUNICATIONS															
		Printers Measure and Conversion	Interpret Charts, Tables, Graphs	Coding	+ - x ÷	Cost Factors	Ratio and Proportion	Measure	Fractions and %	Conversion	Ordering	Metric	Rounding	Geometry	Basic Math	Math shortcuts		Job ticket	Samples	Instructions/trade jargon	Equipment capability	Schedule	Customer/job specifications	Layout	Policy	Write legible instructions	Oral Communications	Operating Manual	Proofreading marks	Maintenance Manual	Reading	Writing	
A-1a	Sort materials																	✓	✓														
A-2a	Select type, paper, ink and production meth.	✓	✓		✓		✓											✓	✓	✓	✓	✓											
A-2b	Determine sequence and expedite																				✓				✓								
A-1a	Mark camera copy	✓	✓					✓										✓	✓														
A-3b	Mark composition copy	✓																✓	✓	✓				✓	✓								
A-4a	Prepare sketches	✓	✓		✓	✓													✓	✓													
A-4b	Prepare comprehensive layout	✓	✓	✓			✓	✓												✓	✓	✓											
A-5a	Edit proof	✓	✓				✓	✓																									
A-6a	Prepare single and multiple sheet dummies	✓	✓																														
A-7a	Sort materials			✓																					✓								
A-7b	File art work and maintain records																			✓	✓	✓				✓							
B-1a	Sort material	✓	✓				✓	✓												✓	✓	✓											
B-1b	Fit and mark composition copy	✓	✓				✓	✓												✓	✓	✓											
B-1c	Distribute materials																									✓							
B-2a	Set-up "strike On" composing machine	✓	✓				✓	✓	✓											✓	✓	✓		✓									
B-2b	Set-up "photo" composing machine	✓	✓	✓		✓	✓	✓	✓	✓	✓									✓	✓	✓											
B-3a	Operate "strike-on" machine	✓	✓	✓																✓	✓	✓		✓									
B-3b	Operate "photo" machine	✓	✓	✓				✓	✓											✓	✓	✓											
B-4a	Check final copy for acceptability	✓	✓																	✓	✓	✓		✓				✓	✓				
B-4b	Correct final copy for machine errors																			✓	✓	✓						✓	✓				
B-5a	Lubricate the composing machine				✓																												
B-5b	Clean lint, dust, grease and corrosion from machine																																
B-5c	Adjust machine and perform minor repairs		✓																											✓	✓		
C-1a	Verify presence of requested copy																	✓							✓								
C-1b	Mark and distribute copy																																
C-2a	Construct layout sheet dimensions	✓			✓																	✓											
C-2b	Mark for proper proportions	✓	✓				✓																										
C-3a	Position window and cut to size	✓	✓				✓																										
C-3b	Block out window	✓																															
C-4a	Attach the copy elements																	✓		✓	✓												

BASIC SKILLS PROJECT

Lithographic Printing Occupations

BASIC SKILLS DISTRIBUTION CHART

TASK STATEMENTS		MATH																COMMUNICATIONS																	
		Printers Measure and Conversion	Interpret Charts, Tables, Graphs	Coding	+ - x ÷	Cost Factors	Ratio and Proportion	Measure	Fractions and %	Conversion	Ordering	Metric	Rounding	Geometry	Basic Math	Math shortcuts		Job ticket	Samples	Instructions/trade jargon	Equipment capability	Schedule	Customer/job specifications	Layout	Policy	Write legible instructions	Oral Communications	Operating Manual	Proofreading marks	Maintenance Manual	Reading	Writing			
C-5a	Inspect paste-up	✓	✓				✓																												
C-5b	Make corrections to paste-up	✓	✓				✓																												
D-1a	Sort and distribute materials																	✓																	
D-2a	Check for completeness, specification requirements and clarity	✓	✓																✓	✓	✓	✓									✓				
D-3a	Proof and mark materials																			✓	✓	✓							✓						
D-4a	Organize, mark and distribute materials																																		
E-1a	Sort copy																																		
E-1b	Sort and make line copy	✓	✓	✓				✓													✓	✓	✓												
E-1c	Sort and make half-tone copy	✓	✓	✓				✓													✓	✓	✓												
E-1d	Mark camera sequence	✓	✓	✓		✓		✓													✓	✓	✓												
E-2a	Mix chemicals			✓				✓													✓														
E-2b	Prepare sink, check safe and inspection lights and verify presence of tools and supp.			✓		✓		✓		✓											✓														
E-3a	Set camera controls			✓				✓													✓														
E-4a	Load and expose film and print material			✓				✓													✓														
E-4b	Process exposed film or print material			✓				✓													✓														
E-5a	Load and expose film and/or print material			✓				✓													✓														
E-6a	Inspect, clean and repair illimination system					✓				✓											✓														
E-6b	Inspect, clean and repair mechanical compon.					✓															✓														
E-6c	Inspect and clean automatic film processor and drier																				✓														
F-1a	Sort materials																																		
F-1b	Mark masking sequence																																		
F-2a	Repair masking sheet	✓	✓			✓				✓																									
F-2b	Impose and tape negatives	✓	✓			✓																													
F-3a	Open windows	✓	✓				✓																												
F-3b	Opaque negatives						✓																												
F-4a	Clean and inspect tools	✓													✓																				
F-4b	Sharpen tools			✓		✓		✓		✓		✓																								
G-1a	Sort materials																																✓		

BASIC SKILLS PROJECT

Lithographic Printing Occupations

BASIC SKILLS DISTRIBUTION CHART

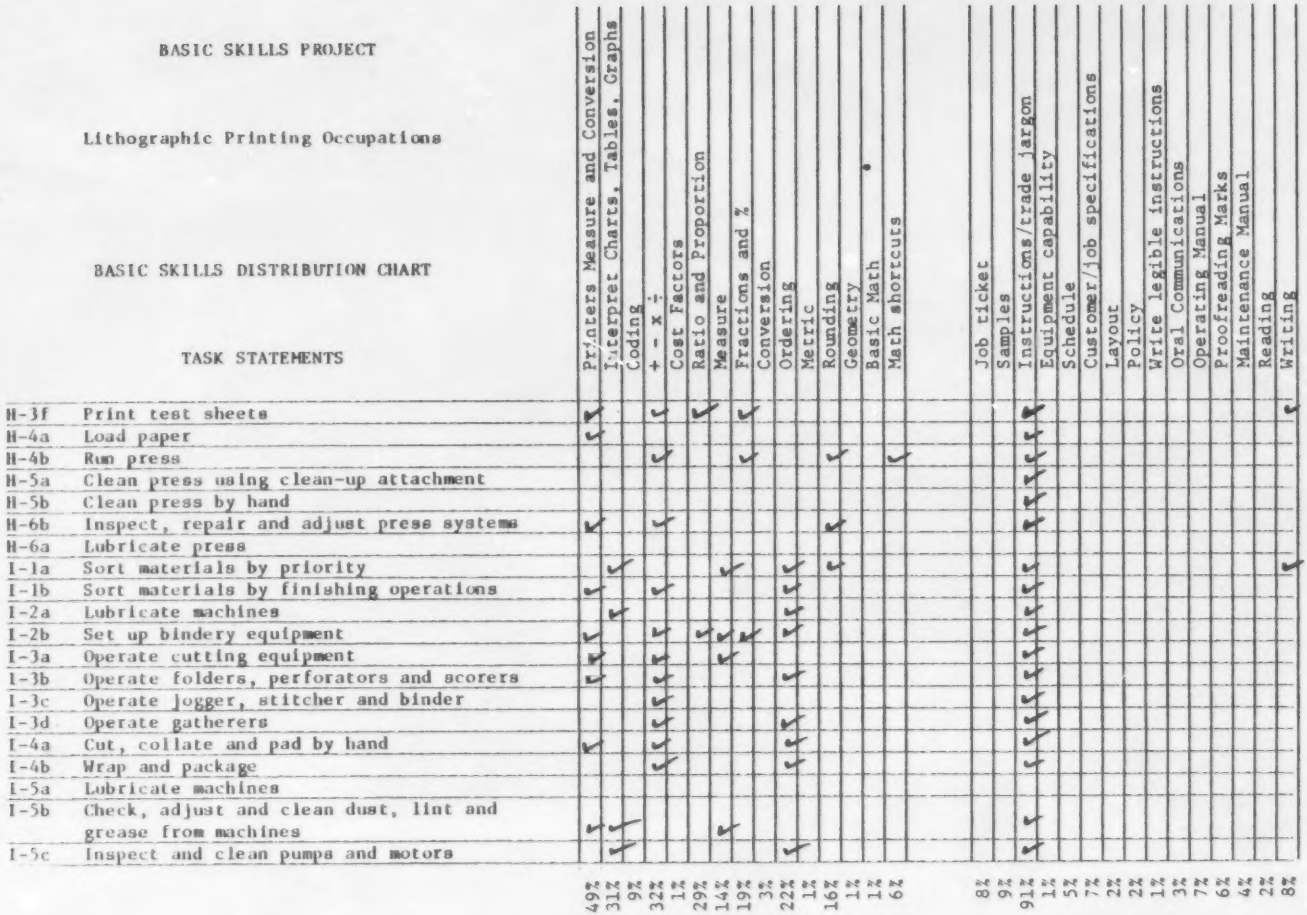
	TASK STATEMENTS	MATH																				COMMUNICATIONS																							
		Printers Measure and Conversion	Interpret Charts, Tables, Graphs	Coding	+ - x ÷	Cost Factors	Ratio and Proportion	Measure	Fractions and %	Conversion	Ordering	Metric	Rounding	Geometry	Basic Math	Math Shortcuts						Job Ticket	Samples	Instructions/trade jargon	Equipment capability	Schedule	Customer/job specifications	Layout	Policy	Write legible instructions	Oral Communications	Operating Manual	Proofreading marks	Maintenance Manual	Reading	Writing									
G-1b	Inspect flats and distribute materials	✓	✓								✓												✓												✓										
G-2a	Select plate and determine exposure time	✓	✓	✓	✓	✓	✓																✓																						
G-2b	Burn plate	✓	✓	✓	✓	✓	✓																✓																						
G-3a	Apply chemicals, inspect and store plate		✓	✓	✓		✓	✓															✓												✓										
G-3b	Prepare processor		✓	✓			✓	✓	✓	✓			✓										✓												✓										
G-3c	Process plates			✓					✓	✓	✓												✓												✓										
G-4a	Select proof material and determine exposure time		✓					✓	✓																																				
G-4b	Burn proof	✓						✓	✓																																				
G-5a	Apply chemicals				✓		✓		✓																																				
G-5b	Mount and route proofs										✓	✓																																		
G-6a	Inspect, clean and repair illumination system			✓	✓						✓																																		
G-6b	Inspect, clean, lubricate and repair platemaker air systems			✓											✓																														
G-6c	Inspect, clean, adjust and servide developing equipment				✓		✓	✓					✓	✓																																
H-1a	Sort and inspect materials	✓					✓	✓	✓		✓	✓	✓	✓		✓																														
H-1b	Distribute materials		✓	✓					✓	✓	✓	✓	✓	✓		✓																														
H-2a	Lubricate press		✓	✓							✓	✓	✓	✓																																
H-2b	Turn press over			✓																																									
H-2c	Check vacuum system		✓																																										
H-2d	Inspect and pack blanket	✓	✓		✓	✓					✓	✓	✓	✓		✓																														
H-2e	Inspect and pack impression cylinder	✓	✓		✓	✓																																							
H-2f	Inspect and pack plate cylinder	✓	✓		✓	✓																																						
H-2g	Check and set dampener rollers	✓	✓		✓	✓	✓		✓							✓																														
H-2h	Check and set ink rollers	✓	✓		✓	✓	✓																																						
H-2i	Mix solution and fill dampener foundain	✓	✓		✓	✓	✓		✓		✓																																		
H-3a	Install plate	✓	✓		✓	✓																																							
H-3b	Set feed system	✓	✓		✓	✓																																						
H-3c	Set delivery system	✓	✓		✓	✓																																						
H-3d	Ink press	✓	✓		✓	✓																																						

BASIC SKILLS PROJECT

Lithographic Printing Occupations

BASIC SKILLS DISTRIBUTION CHART

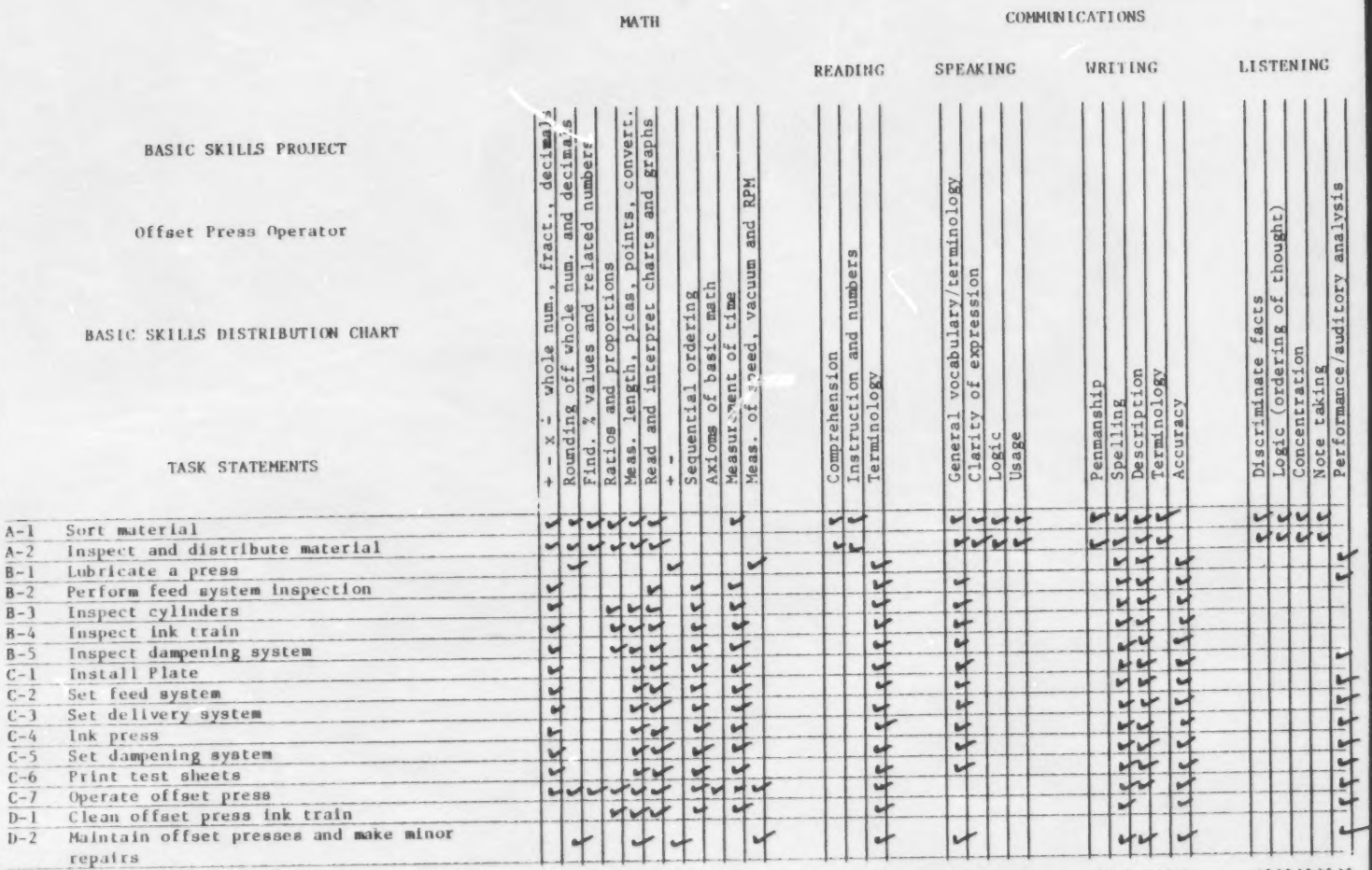
TASK STATEMENTS



BASIC SKILLS PROJECT

Offset Press Operator

BASIC SKILLS DISTRIBUTION CHART

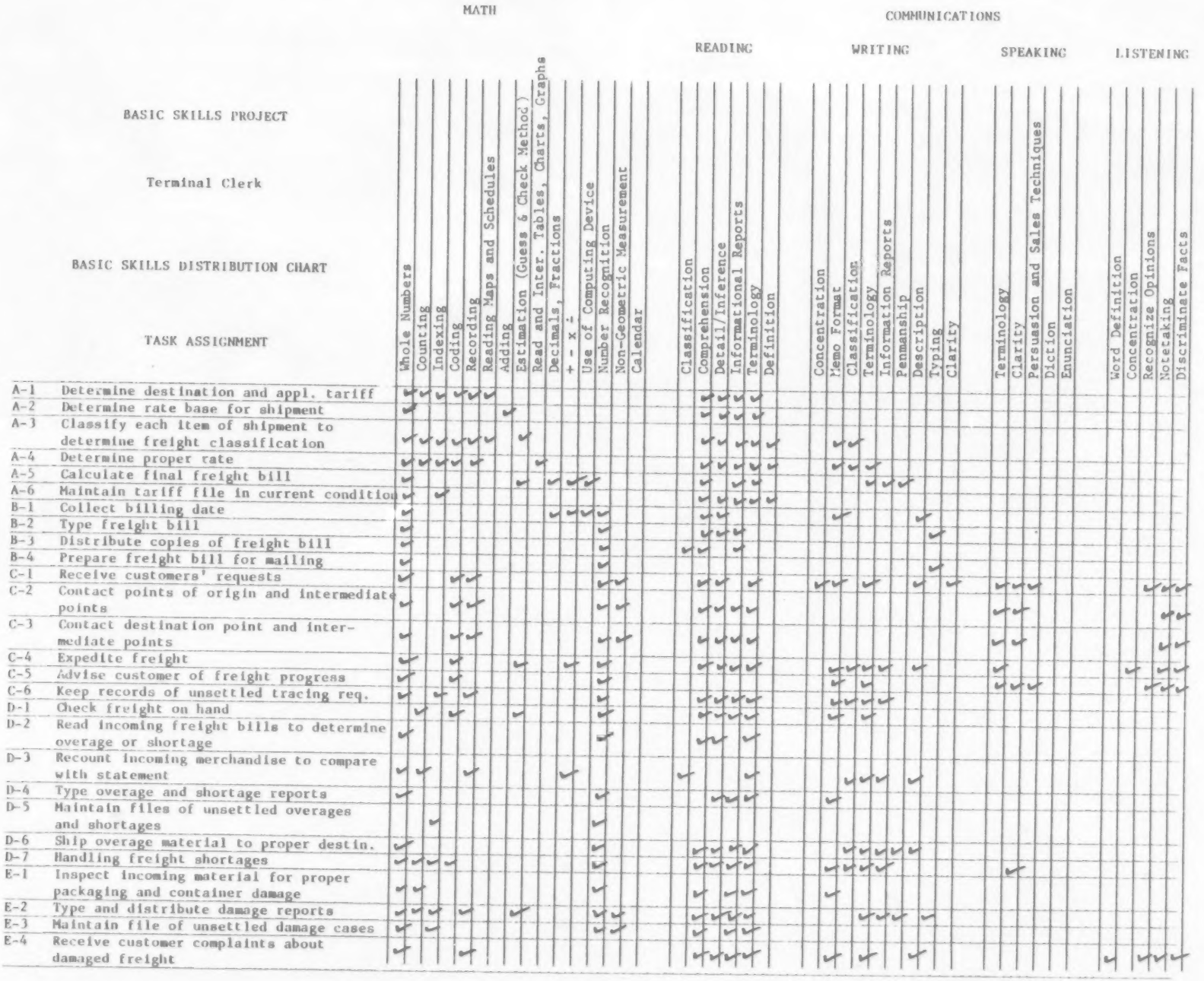


BASIC SKILLS PROJECT

Terminal Clerk

BASIC SKILLS DISTRIBUTION CHART

TASK ASSIGNMENT

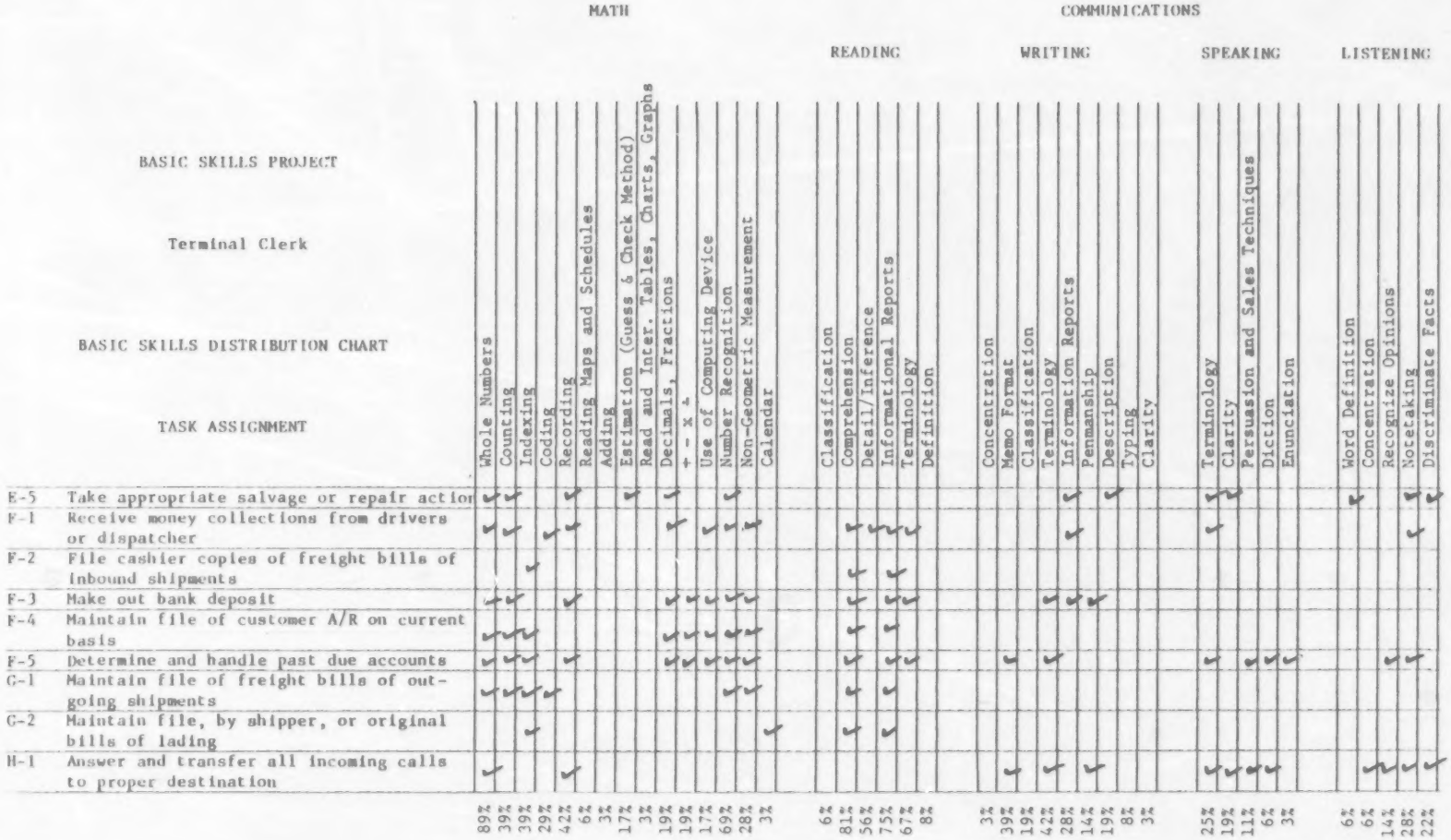


BASIC SKILLS PROJECT

Terminal Clerk

BASIC SKILLS DISTRIBUTION CHART

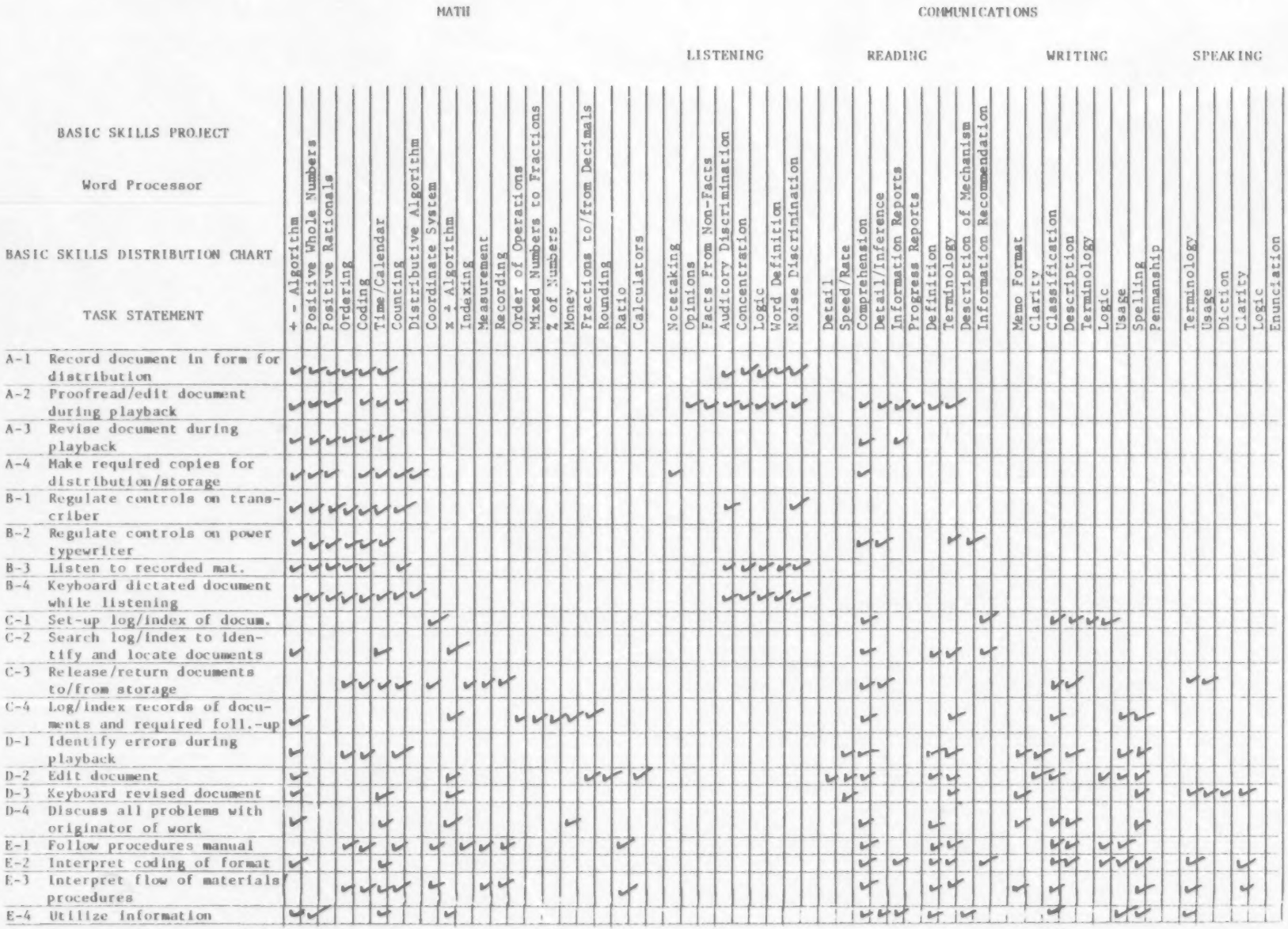
TASK ASSIGNMENT



BASIC SKILLS PROJECT

Word Processor

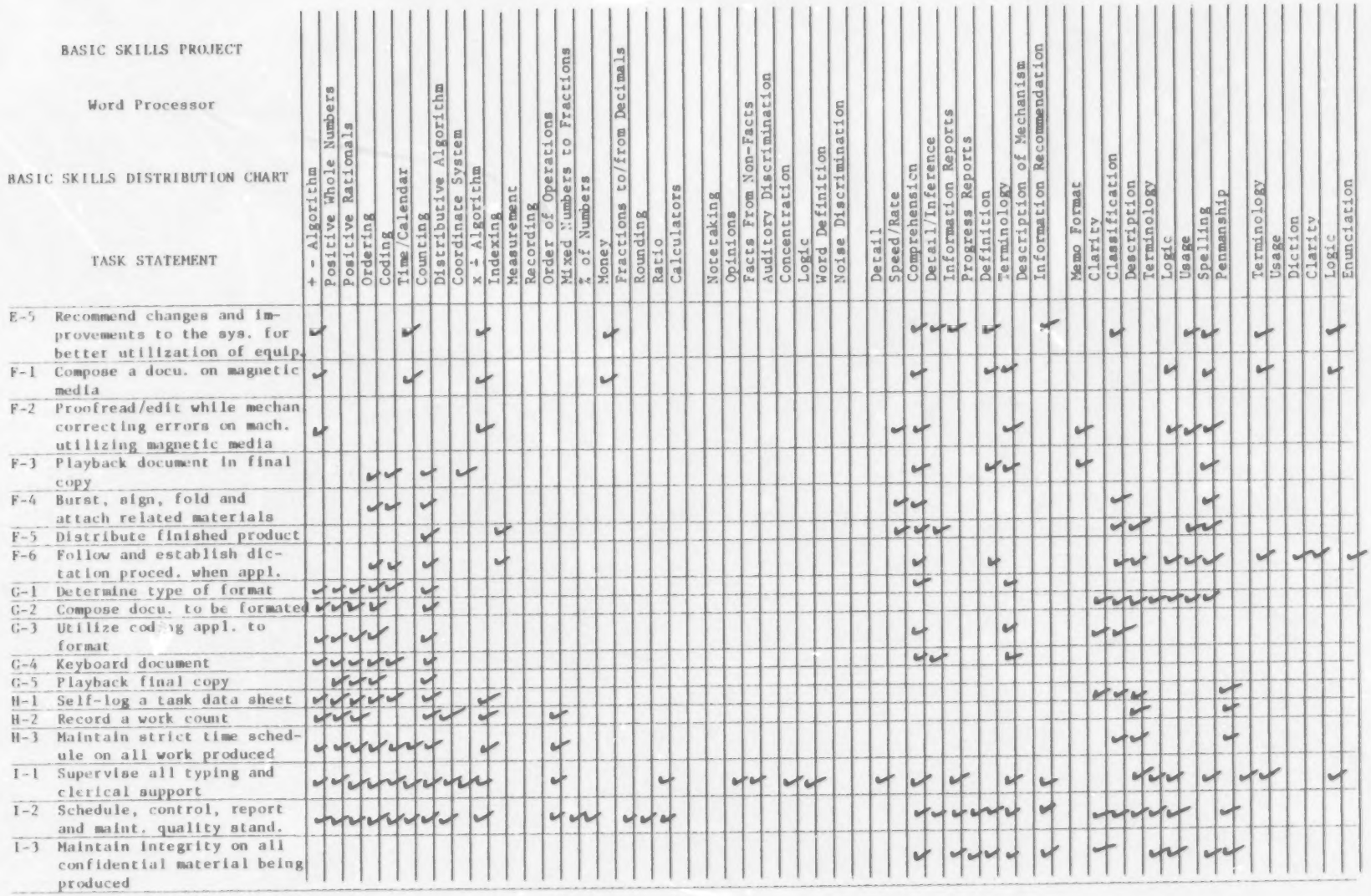
BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Word Processor

BASIC SKILLS DISTRIBUTION CHART



BASIC SKILLS PROJECT

Word Processor

BASIC SKILLS DISTRIBUTION CHART

| TASK STATEMENT | MATH | | |

Appendix D

SIGNIFICANT AND/OR DOMINANT COMMERCIALLY AVAILABLE
VOCATIONAL INSTRUCTIONAL TEXTS

Agricultural Education

Agriculture Production

Ensminger, M. E. Beef Cattle Science. 5th edition. Danville: Interstate, 1976.

Ensminger, M. E. Dairy Cattle Science. Danville: Interstate, 1979.

Ensminger, M. E. Horses and Horsemanship. Danville: Interstate, 1977.

Ensminger, M. E. Poultry Science. Danville: Intersate, 1971.

Ensminger, M. E. Swine Science. Danville: Interstate, 1970.

Ensminger, M. E. The Stockman's Handbook. Danville: Interstate, 1978.

Ensminger, M. E. & Olentine, C. G. Jr. Feeds and Nutrition - abridged. Clovis: The Ensminger Publishing Co., 1978.

Hunsley, R. E., W. M. Beeson, Julius E. Nordby. Livestock Judging, Selection and Evaluation. Danville: Interstate, 1978.

Mortenson, W. P., R. A. Luening. The Farm Management Handbook. 6th edition. Dnaville: Interstate, 1979.

Peterson, Paul. Working in Animal Science. New York: McGraw Hill, 1978.

Agriculture Supplies/Business Services

Higgs, Roger, Charles Heidenreich, Richard Loberger, Robert Cropps, Milton Mitchell. Agricultural Mathematics. Danville: Interstate, 1973.

Higgs, Roger, Charles Heidenreich, Richard Loberger, Robert Cropps, Milton Mitchell. Agricultural Mathematics. Danville: Interstate, 1973.

Hopkin, John A., Peter J. Barry, C. B. Baker. Financial Management in Agriculture. Danville: Interstate, 1979.

Agriculture Mechanics

Boyd, James S. Practical Farm Buildings: A Text and Handbook. Danville: Interstate, 1979.

Kugler, Harold L. Arc Welding Lessons. Cleveland: The James F. Lincoln Arc Welding Foundation, 1965.

Phipps, Lloyd J. Mechanics in Agriculture. Danville: Interstate, 1977.

Wakeman, T. J. Modern Agricultural Mechanics. Danville: Interstate, 1977.

Wakeman, T. J. and McCoy, Vernon L. The Farm Shop. New York: MacMillan Publishers, 1960.

Agriculture Ornamental Horticulture

Ball, George J. Ball Red Book. West Chicago: George J. Ball, Inc., 1975.

Nelson, Kennard S. Flower and Plant Production in the Greenhouse. Danville: Interstate, 1978.

Nelson, Kennard S. Greenhouse Management for Flower and Plant Production. Danville: Interstate, 1980.

Pfahl, Peter B. The Retail Florist Business. Danville: Interstate, 1977.

Reiley, H. Edward, Carroll L. Shorty, Jr. Introductory Horticulture. Albany: Delmar Publishers, 1979.

Sprague, Howard. Turf Management Handbook. Danville: Interstate, 1976.

Agricultural Resources

Forestry

Anderson, David A., William A. Smith. Forests and Forestry. Danville: Interstate, 1976.

Bromley, Willard S. Pulpwood Production. Danville: Interstate, 1976.

Distributive Education

Real Estate

Wigginton, F. Peter. Residential Real Estate Practice. Indianapolis: Bobbs-Merrill, 1978.

Apparel and Accessories

Mullikin. Selling Fashion Apparel. Cincinnati: South-Western, 1971.

Peltz, Leslie Ruth. Fashion: Color, Line, and Design. Indianapolis: Bobbs-Merrill, 1980.

Peltz, Leslie Ruth. Fashion Accessories. Indianapolis: Bobbs-Merrill, 1980.

Home Furnishings

Kaplan, Barbara. Home Furnishings. Indianapolis: Bobbs-Merrill, 1975.

Peltz, Leslie Ruth. Merchandising Mathematics. Indianapolis: Bobbs-Merrill, 1979.

Food Services

Axler, Bruce H. Breakfast Cookery. Indianapolis: Bobbs-Merrill, 1974.

Axler, Bruce H. Tableservice Techniques. Indianapolis: Bobbs-Merrill, 1974.

Lehmann, Armin D. Travel and Tourism: An Introduction to Travel Agency Operations. Indianapolis: Bobbs-Merrill, 1978.

Vastano, Joseph F. Elements of Food Production and Baking. Indianapolis: Bobbs-Merrill, 1978.

Marketing & Distribution

Kohns. Credit and Collections. Cincinnati: South-Western, 1968.

Mullikin. Selling Fashion Apparel. Cincinnati: South-Western, 1971.

Richert, G. Henry, Warren Meyer, Peter Haines, E. Edward Harris. Retailing Principles and Practices. New York: McGraw Hill, 1974.

Samson. Advertising: Planning and Techniques. Cincinnati: South-Western, 1979.

Samson and Little. Display: Planning and Techniques. Cincinnati: South-Western, 1979.

Samson and Palmer. Selecting and Buying Merchandise. Cincinnati: South-Western, 1974.

Stull. Marketing Math. Cincinnati: South-Western, 1979.

Warmke, Plamer, Nolan. Marketing in Action. Cincinnati: South-Western, 1976.

Wingate and Nolan. Fundamentals of Selling. Cincinnati: South-Western, 1976.

Wingate and Samson. Retail Merchandising. Cincinnati: South-Western, 1975.

Health Occupations

Caldwell, E., Ph.D., B. Hegner, M.S., R.N. Geriatrics: A Study of Maturity.

Conger. Child Care Aide Skills. New York: McGraw Hill.

Fisher, J. Patrick. Basic Medical Terminology. Indianapolis: Bobbs-Merrill, 1975.

Lee, Ruth M. Orientation to Health Services. Indianapolis: Bobbs-Merrill, 1978.

Lo[illegible]zen, Betty Jo. Dental Assistant Techniques. Indianapolis: Bobbs-Merrill, 1975.

Office Occupations

Shorthand

Christensen and Bell. Century 21 Shorthand: Theory and Practice. Cincinnati: South-Western, 1974.

Christensen and Bell. Century 21 Shorthand: Theory and Practice Transcript. Cincinnati: South-Western.

Craft, Bernice R., Rose Palmer, David Wertheimer. Speedwriting for the Legal Secretary. Indianapolis: Bobbs-Merrill, 1979.

Gregg, John R., Louis A. Leslie, Charles E. Zoubek. Gregg Shorthand. New York: McGraw Hill.

Haggblade and Oliverio. Century 21 Shorthand: Intensive Dictation/ Transcription. Cincinnati: South-Western, 1974.

Haggblade and Oliverio. Century 21 Shorthand: Intensive Dictation/ Transcription Transcript. Cincinnati: South-Western.

Landmark Series. Principles of Speedwriting. Indianapolis: Bobbs-Merrill, 1977.

Leslie, Louis A., Charles E. Zoubek, Olern M. Henson. Gregg Shorthand, Individual Progress Method. Diamond Jubilee Series, New York: McGraw Hill, 1972.

Leslie, Louis A., Charles E. Zoubek, A. James Lemaster, Madeline S. Strony. Gregg Dictation and Introductory Transcription.

Stoddard. Century 21 Shorthand: Advanced Dictation/Transcription. Cincinnati: South-Western, 1975.

Stoddard. Century 21 Shorthand: Advanced Dictation/Transcription Transcript. Cincinnati: South-Western.

Filing

Bassett and Goodman. Alphabetic Filing Procedures. Cincinnati: South-Western.

Bassett and Goodman. Business Filing and Records Control. Cincinnati: South-Western, 1974.

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Appendix E

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